MOHAN BABU UNIVERSITY

Sree Sainath Nagar, Tirupati – 517 102

SCHOOL OF COMPUTING

B.Tech. Computer Science and Engineering (Cyber Security)

CURRICULUM AND SYLLABUS
(From 2022-23 Admitted Batches)

FULLY FLEXIBLE CHOICE BASED CREDIT SYSTEM (FFCBCS)

MOHAN BABU UNIVERSITY

Vision

To be a globally respected institution with an innovative and entrepreneurial culture that offers transformative education to advance sustainability and societal good.

Mission

- ❖ Develop industry-focused professionals with a global perspective.

- ❖ Offer academic programs that provide transformative learning experience founded on the spirit of curiosity, innovation, and integrity.

- ❖ Create confluence of research, innovation, and ideation to bring about sustainable and socially relevant enterprises.

- ❖ Uphold high standards of professional ethics leading to harmonious relationship with environment and society.

SCHOOL OF COMPUTING

Vision

To lead the advancement of computer science research and education that has real-world impact and to push the frontiers of innovation in the field.

Mission

- ❖ Instil within our students fundamental computing knowledge, a broad set of skills, and an inquisitive attitude to create innovative solutions to serve industry and community.

- ❖ Provide an experience par excellence with our state-of-the-art research, innovation, and incubation ecosystem to realise our learners' fullest potential.

- ❖ Impart continued education and research support to working professionals in the computing domain to enhance their expertise in the cutting-edge technologies.

❖ Inculcate among the computing engineers of tomorrow with a spirit to solve societal challenges.

DEPARTMENT OF DATA SCIENCE

Vision

To become a nationally recognized quality education center in the domain of Computer Science and Cyber Security through teaching, training, learning, research and consultancy.

Mission

❖ The Department strives to produce high quality information technologists and Cyber security Professionals by disseminating knowledge through contemporary curriculum, competent faculty and adopting effective teaching-learning methodologies.

❖ Igniting passion among students for research and innovation by exposing them to real time systems and problems

❖ Developing technical and life skills in diverse community of students with modern training methods to solve problems in Software Industry.

❖ Inculcating values to practice engineering in adherence to code of ethics in multicultural and multi discipline teams.

B.Tech. Computer Science and Engineering (Cyber Security)

PROGRAM EDUCATIONAL OBJECTIVES

After few years of graduation, the graduates of B.Tech.CSE (CS) will:

PEO1. Pursue higher education in reputed institutions in the field of Computer Science, Cyber Security or management.

PEO2. Accomplish successful professional career in IT-enabled industries with skills in prevention, investigation and alleviate the cyber-attacks.

PEO3. Evolve as entrepreneurs by acquiring required skills to solve the issues in real world cyber security domain and to develop reliable systems to prevent and protect systems from security attack.

PEO4. Develop innovative engineering tools and techniques using research and complex problem solving skills through life-long learning and exhibit high ethical attitude in professional practice.

PROGRAM OUTCOMES

On successful completion of the Program, the graduates of B.Tech. CSE (CS) Program will be able to:

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance**: Demonstrate knowledge andunderstanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

On successful completion of the Program, the graduates of B. Tech. CSE (CS) program will be able to:

PS01. Design, implement and evaluate a security system to identify, prevent and protect from vulnerabilities and cyber attacks.

PS02. Develop solutions using Computer Science and Cyber Security Tools and Techniques to address societal issues.

PS03. Design and Develop algorithms and applications using modern tools, technologies and platforms to solve real-time problems.

PS04. Apply database tools and techniques to store, process, retrieval of data and perform data analytics.

B.Tech. Computer Science and Engineering (Cyber Security)

Basket Wise - Credit Distribution

(Regular – 4 Years Program)

S. No.	Basket	Credits (Min.- Max.)
1	SCHOOL CORE	50-54
2	PROGRAM CORE	45-61
3	PROGRAM ELECTIVE	12-18
4	SPECIALIZATION ELECTIVE	24-36
5	UNIVERSITY ELECTIVE	9-12
	TOTAL CREDITS	Min. 160

Basket Wise - Credit Distribution

(Lateral Entry – 3 Years Program)

S. No.	Basket	Credits (Min.- Max.)
1	SCHOOL CORE	20-34
2	PROGRAM CORE	45-61
3	PROGRAM ELECTIVE	12-18
4	SPECIALIZATION ELECTIVE	24-36
5	UNIVERSITY ELECTIVE	9-12
	TOTAL CREDITS	Min. 120

School Core (50-54 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22MM102453	Physics for Computing	3	-	2	-	4	-
22EE102401	Basic Electrical and Electronics Engineering	3	-	2	-	4	-
22CS102001	Programming for Problem Solving	3	-	2	-	4	-
22AI105001	Design Thinking	-	1	2	-	2	-
22CB111001	Internship	-	-	-	-	2	-
22CB108001	Capstone Project	-	-	-	-	10	-
Language Basket (Min. 4 Credits to be earned)							
22LG102401	English for Professionals	2	-	2	-	3	
22LG105402	Soft Skills	-	-	2	-	1	
22LG101403	German Language	2	-	-	-	2	
22LG101404	French Language	2	-	-	-	2	
22LG102402	Empowering Your English	2	-	2	-	3	
Mathematics Basket (Min. 12 Creditsto be earned)							
22MM101403	Calculus and Transformation Techniques	3	-	-	-	3	-
22MM101401	Matrix Theory and Linear Algebra	3	-	-	-	3	-
22MM101405	Numerical Methods, Probability and Statistics	3	-	-	-	3	-
22MM101407	Number Theory and Algebra	3	-	-	-	3	-
22MM101408	Statistics for Engineers	3	-	-	-	3	Numerical Methods, Probability and Statistics
22MM102403	Calculus and Transformation Techniques	3	-	2	-	4	-
Introduction to Computer Science (Min. 2 Creditsto be earned)							
22AI105002	Disruptive Technologies	-	1	2	-	2	-
22AI105003	Free and Open Source Software	-	1	2	-	2	-

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22CB105001	Computer Hardware and System Essentials	-	1	2	-	2	-
Programming Languages (Min. 5 Creditsto be earned)							
22AI104001	Object Oriented Programming through C++	3	-	2	4	5	Programming for Problem Solving
22AI104002	Object Oriented Programming through Java	3	-	2	4	5	Programming for Problem Solving
Management Basket (Min. 5 Creditsto be earned)							
22CM101401	Principles of Business Economics and Accountancy	3	-	-	-	3	-
22MG101401	Essentials of Leadership	2	-	-	-	2	-
22MG101402	Organizational Behaviour	2	-	-	-	2	-
22MG101403	Project Management	2	-	-	-	2	-
Mandatory Courses (Min. 8 Creditsto be earned - Earned Credits will not be considered for CGPA)							
22LG107601	Professional Ethics and Human Values	2	-	-	-	2	-
22CE107601	Environmental Science*	2	-	-	-	2	-
22CE107602	Disaster Mitigation and Management	2	-	-	-	2	-
22CE107603	Rural Technology	2	-	-	-	2	-
22LG107603	Spoken English	-	1	2	-	2	English for Professionals
22LG107602	Essential Life Skills for Holistic Development	2	-	-	-	2	-
22AB107601	NCC/NSS Activities	-	-	-	-	2	-
22AB107602	Yoga	2	-	-	-	2	-
22MG107401	Innovation, Incubation and Entrepreneurship	2	-	-	-	2	-
22EE107001	Intellectual Property Rights	2	-	-	-	2	-
22EE107002	Fundamentals of Research Methodology						

*Compulsory Course

School Core (20-34 Credits) - (Lateral Entry – 3 Years Program)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	**T**	**P**	**S**	**C**	
22MM102453	Physics for Computing	3	-	2	-	4	-
22EE102401	Basic Electrical and Electronics Engineering	3	-	2	-	4	-
22CS102001	Programming for Problem Solving	3	-	2	-	4	-
22AI105001	Design Thinking	-	1	2	-	2	-
22CS111001	Internship	-	-	-	-	2	-
22CS108001	Capstone Project	-	-	-	-	10	-
22LG102401	English for Professionals	2	-	2	-	3	-
22LG105402	Soft Skills	-	-	2	-	1	-
22LG101403	German Language	2	-	-	-	2	-
22LG101404	French Language	2	-	-	-	2	-
22MM101403	Calculus and Transformation Techniques	3	-	-	-	3	-
22MM101401	Matrix Theory and Linear Algebra	3	-	-	-	3	-
22MM101405	Numerical Methods, Probability and Statistics	3	-	-	-	3	-
22MM101407	Number Theory and Algebra	3	-	-	-	3	-
22MM101408	Statistics for Engineers	3	-	-	-	3	-
22AI105002	Disruptive Technologies	-	1	2	-	2	-
22AI105003	Free and Open Source Software	-	1	2	-	2	-
22CB105001	Computer Hardware and System Essentials	-	1	2	-	2	-
22AI104001	Object Oriented Programming through C++	3	-	2	4	5	-

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
22AI104002	Object Oriented Programming through Java	3	-	2	4	5	-
22CM101401	Principles of Business Economics and Accountancy	3	-	-	-	3	-
22MG101401	Essentials of Leadership	2	-	-	-	2	-
22MG101402	Organizational Behaviour	2	-	-	-	2	-
22MG101403	Project Management	2	-	-	-	2	-
Mandatory Courses (Min. 6 Credits to be earned - Earned Credits will not be considered for CGPA)							
22LG107601	Professional Ethics and Human Values	2	-	-	-	2	-
22CE107601	Environmental Science*	2	-	-	-	2	-
22CE107602	Disaster Mitigation and Management	2	-	-	-	2	-
22CE107603	Rural Technology	2	-	-	-	2	-
22LG107603	Spoken English	-	1	2	-	2	-
22LG107602	Essential Life Skills for Holistic Development	2	-	-	-	2	-
22AB107601	NCC/NSS Activities	-	-	-	-	2	-
22AB107602	Yoga	-	-	-	-	2	-
22MG107401	Innovation, Incubation and Entrepreneurship	2	-	-	-	2	-
22EE107001	Intellectual Property Rights	2	-	-	-	2	-
22EE107002	Fundamentals of Research Methodology	2	-	-	-	2	-

* Compulsory Course

Program Core (45–61 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22AI101001	Discrete Mathematical Structures	3	-	-	-	3	-
22AI101002	Theory of Computation	3	-	-	-	3	-
22IT101001	Software Engineering	3	-	-	-	3	-
22CS101001	Digital Logic Design	3	-	-	-	3	-
22CS101002	Computer Organization and Architecture	3	-	-	-	3	Digital Logic Design
22AI102001	Operating Systems	3	-	2	-	4	
22CB102001	Cryptography and Network Security	3	-	2	-	4	Computer Networks
22CB101001	Cyber Security Essentials	3	-	-	-	3	-
22CB102002	Computer Networks	3	-	2	-	4	-
22CB102003	Security Threats and Modeling	3	-	2	-	4	Cryptography and Network Security
22CB102004	Malware Analysis and Penetration Testing	3	-	2	-	4	Computer Networks
22CB102005	Ethical Hacking	3	-	2	-	4	Computer Networks
22CS102002	Python Programming	3	-	2	-	4	-
22CS102003	Data Structures	3	-	2	-	4	-
22CS102004	Design and Analysis of Algorithms	3	-	2	-	4	-
22CS102005	Database Management Systems	3	-	2	-	4	-
22CS102006	Compiler Design	3	-	2	-	4	Theory of Computation
22IT104001	Web Technologies	3	-	2	4	5	Object Oriented Programming through JAVA

Program Elective (12-18Credits)

Course Code	Knowledge Area	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
			L	T	P	S	C	
22CS101005	Computing	Distributed Systems	3	-	-	-	3	-
22CS101006		High Performance Computing	3	-	-	-	3	-
22DS101013		Generative AI	3	-	-	-	3	Python Programming
22DS101014		Expandable AI	3	-	-	-	3	Machine Learning
22IT102003	Networks	Cloud Computing	3	-	2	-	4	-
22CB101002		Mobile Computing	3	-	-	-	3	Computer Networks
22CB102006		Internet of Things	3	-	2	-	4	Computer Networks
22CS101011		Ad-hoc and Wireless Sensor Networks	3	-	-	-	3	Computer Networks
22CB101018		Semantic Web and Social Networks	3	-	-	-	3	Computer Networks, Web Technologies
22CB101021		5G Technologies	3	-	-	-	3	Computer Networks
22AI101017	Information Management	Data Mining	3	-	-	-	3	Database Management Systems
22CB101019		Mobile Databases	3	-	-	-	3	Computer Networks and Database Management Systems
22DS102002		Big Data Technologies	3	-	2	-	4	Database Management Systems
22CB101020		Digital and Social Media Marketing	3	-	-	-	3	Computer Networks
22AI102003		Machine Learning	3	-	2	-	4	
22CS102008	Programming Languages	Advanced Java programming	3	-	2	-	4	Object Oriented Programming through Java
22CS105001		R Programming	-	1	2	-	2	-
22CB102007		Network Programming	3	-	2	-	4	Computer Networks
22CS102007		Linux Programming	3	-	2	-	4	Programming for Problem Solving
22CS104001	Platform Based Development	MERN Stack Development	3	-	2	4	5	Web Technologies
22CS104002		Mobile Application Development	3	-	2	4	5	Object Oriented Programming through Java

Specialization Elective (24-36Credits)

Course Code	Title of the Course	Lecture L	Tutorial T	Practical P	Project based Learning S	Credits C	Pre-requisite
22CB101003	Secure Software Engineering	3	-	-	-	3	Software Engineering and Computer Networks
22CB101004	Secure Coding Practices	3	-	-	-	3	Cyber Security Essentials
22CB101005	Mobile Application Security	3	-	-	-	3	Cyber Security Essentials
22CB101006	System Security	3	-	2	-	4	Computer Networks
22CB102008	Web Application Security	3	-	2	-	4	Web Technologies
22CB101007	Database and Web Security	3	-	-	-	3	-
22CB101008	Digital Watermarking and Steganography	3	-	-	-	3	Cryptography and Network Security
22CB101009	Blockchain Technologies	3	-	-	-	3	Cryptography and Network Security
22CB101010	Machine Learning for Cyber Security	3	-	-	-	3	Cyber Security Essentials and Machine Learning
22CB101011	Cloud Security	3	-	-	-	3	Cloud Computing
22CB104001	Cyber Forensics and Investigation	3	-	2	4	5	Cyber Security Essentials
22CB101012	Cyber Physical System Security	3	-	-	-	3	Computer Networks
22CB101013	Wireless and Mobile Security	3	-	-	-	3	Mobile Computing
22CB101014	IoT Security	3	-	-	-	3	Internet of Things
22CB101015	Cyber Risk Management	3	-	-	-	3	Cyber Security Essentials
22CB101016	Information Systems Auditing and Assurance	3	-	-	-	3	Computer Networks
22CB101017	Qunantum Cryptography	3	-	-	-	3	Cryptography and Network Security
22CB101022	Qunatum Computing	3	-	-	-	3	Matrix theory and Linear Algebra

University Elective (9-12 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22EC101701	AI in Healthcare	3	-	-	-	3	-
22CM101701	Banking and Insurance	3	-	-	-	3	-
22DS101701	Bioinformatics	3	-	-	-	3	-
22BS101701	Biology for Engineers	3	-	-	-	3	-
22LG101701	Business Communication and Career Skills	3	-	-	-	3	-
22CE101701	Civil Engineering and The Society	3	-	-	-	3	-
22SS101701	Constitution of India	3	-	-	-	3	-
22CM101702	Cost Accounting and Financial Management	3	-	-	-	3	-
22CB101701	Cyber Laws and Security	3	-	-	-	3	-
22EE101701	Electrical Safety and Safety Management	3	-	-	-	3	-
22MG101701	Entrepreneurship for Micro, Small and Medium Enterprises	3	-	-	-	3	-
22CE101702	Environmental Pollution and Control	3	-	-	-	3	-
22EC101702	Essentials of VLSI	3	-	-	-	3	-
22CB101702	Introduction to Ethical Hacking	3	-	-	-	3	-
22CB101703	Forensic Science	3	-	-	-	3	-
22SS101702	Gender and Environment	3	-	-	-	3	-
22ME101701	Global Strategy and Technology	3	-	-	-	3	-
22EE101704	Green Technologies	3	-	-	-	3	-
22ME101702	Human Resource Management	3	-	-	-	3	-
22SS101703	Indian Economy	3	-	-	-	3	-
22SS101704	Indian History	3	-	-	-	3	-
22SS101705	Indian Tradition and Culture	3	-	-	-	3	-
22EC101703	Instrumentation in Industries	3	-	-	-	3	-

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22EC101704	Introduction to Nanotechnology	3	-	-	-	3	-
22AI101701	Introduction to Artificial Intelligence	3	-	-	-	3	-
22DS101702	Introduction to Data Science	3	-	-	-	3	-
22AI101702	Introduction to Machine Learning	3	-	-	-	3	-
22CS101701	Introduction to Python Programming	3	-	-	-	3	-
22CB101704	Introduction to Internet of Things	3	-	-	-	3	-
22ME101703	Management Science	3	-	-	-	3	-
22ME101704	Managing Innovation and Entrepreneurship	3	-	-	-	3	-
22ME101705	Material Science	3	-	-	-	3	-
22LG101702	Personality Development	3	-	-	-	3	-
22CE101703	Planning for Sustainable Development	3	-	-	-	3	-
22EC101705	Principles of Communication Engineering	3	-	-	-	3	-
22EE101702	Reliability and Safety Engineering	3	-	-	-	3	-
22CE101704	Remote Sensing, GIS and GPS	3	-	-	-	3	-
22CE101705	Smart Cities	3	-	-	-	3	-
22EC101706	Smart Sensors for Engineering Applications	3	-	-	-	3	-
22LG101703	Stress Management and Well Being	3	-	-	-	3	-
22EE101703	Sustainable Energy Systems	3	-	-	-	3	-
22CS101702	Web Design Fundamentals	3	-	-	-	3	-
22SS101706	Women Empowerment	3	-	-	-	3	-

Note:

1. If any student has chosen a course or equivalent course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s under University Elective.
2. The student can choose courses from other disciplines offered across the schools of MBU satisfying the pre-requisite other than the above list.

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM102453	**PHYSICS FOR COMPUTING**	3	-	2	-	4

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on wave optics, Quantum mechanics and its applications, Semiconductor diodes, optoelectronic devices, and Fiber optics.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply the concepts of light waves to interpret the concepts of Interference, Diffraction, and Polarization.
CO2. Demonstrate the basic knowledge of the quantum behaviour of matter in its microstate.
CO3. Analyze the band structure of solid materials using quantum physics.
CO4. Understand the basic concepts of semiconductors in the functioning of various optoelectronic devices.
CO5. Demonstrate the concepts of electromagnetic wave propagation in optical fibers.

CO6. Work independently and in teams to solve problems with effective communications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	1	-	-	-	-	-
CO2	3	2	-	1	-	-	-	-	-	-	-	-
CO3	3	2	-	1	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	1	-	-	-	-	-	-
CO5	3	2	-	-	1	-	-	-	-	-	-	-
CO6	3	2	-	-	-	-	-	1	1	1	-	-
Course Correlation Mapping	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**-**

Correlation Levels: **3: High;**   **2: Medium; 1: Low**

COURSE CONTENT

(10 Periods)

Module 1:   WAVE OPTICS
Interference: Introduction - Interference in thin films (reflected light) - Newton's rings - Determination of wavelength.
Diffraction: Introduction - Fraunhofer diffraction - Single slit diffraction (qualitative) - Double slit diffraction (qualitative).
Polarization: Introduction - Polarization by reflection - and double refraction - Nicol's prism - Half wave and Quarter wave plate - Engineering applications of interference - diffraction and polarization.

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Module 2:   INTRODUCTION TO QUANTUM MECHANICS   *(08 Periods)*
***Principles of Quantum Mechanics*:** Introduction – de Broglie's hypothesis for matter waves - Davison and Germer's experiment - Schrödinger's one dimensional wave equation (time independent) - significance of wave function – Fermi Dirac distribution and effect of temperature (qualitative treatment).

Module 3:   QUANTUM PHYSICS AND BAND THEORY OF SOLIDS: *(08 Periods)*

Applications of Quantum Physics: Particle in a 1 D box (Eigen Value and Eigen Function) – 3 D Analysis (Qualitative) - Tunnelling Effect (Qualitative) - Kronig Penney model (qualitative treatment) - origin of energy bands formation in solids.

Module 4:   SEMICONDUCTORS AND OPTOELECTRONIC   *(11 Periods)*
               DEVICES
Introduction - Intrinsic semiconductors - Density of electrons in intrinsic semiconductor - Intrinsic carrier concentration - Fermi energy - Electrical conductivity of intrinsic semiconductors - Extrinsic semiconductors - Density of charge carriers in Extrinsic semiconductors (qualitative) - Drift and Diffusion currents - Direct and Indirect band gap semiconductors - Hall effect - pn junction
Optoelectronic devices: Light Emitting Diode (LED) - Photodiode - Semiconductor diode laser

Module 5:   FIBER OPTICS   *(08 Periods)*
Introduction to fiber optics - Total Internal Reflection - Critical angle of propagation -Acceptance angle - Numerical Aperture – V number (qualitative) - Classification of fibers based on Refractive index profile, modes - Applications of optical fibers – Fiber optic Sensors (temperature, displacement).

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXPERIMENTS: (Minimum 10 experiments shall be conducted)
1   Estimation of the wavelength of the given laser by using a diffraction grating.
2. Predict the particle size using LASER by using the diffraction phenomenon.
3. Determine the thickness of thin wire using the wedge shape method.
4. Determination of the radius of curvature of the lens/wavelength of monochromatic source by using Newton's ring method
5. Find the numerical aperture of a given optical fiber and hence estimate its acceptance angle.
6. Calculate the number of charge carriers and Hall coefficients of a given semiconductor using the Hall Effect.
7. Find the forward and reverse resistance of a given p-n junction diode from its I-V characteristics curves.
8. Predict the energy gap of a semiconductor by varying the temperatures.
9. Estimation of threshold voltages of different LEDs.
10. Study the characteristics of Photodiode and determine its dark current.
11. Estimation of the magnetic field along the axis of a circular coil carrying current with Stewart Gee's method.
12. Determination of wavelength of light by plane diffraction grating using spectrometer by minimum deviation method.

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RESOURCES

TEXTBOOKS:
1. M.N. Avadhanulu, P.G. Kshirsagar, and T.V.S Arun Murthy, *A Textbook of Engineering Physics*, S. Chand Publications, 11th edition, 2019.
2. R.K. Gaur and S.L. Gupta, *Engineering Physics*, Dhanpat Rai Publications (P) Ltd, 2015.
3. P.K. Palaniswamy,*Engineering Physics*, Scitech Publications India Private Limited, 2ndedition, 2009.
4. Serway and Jewett, *Physics for Scientists and Engineers with Modern Physics*, 6th Edition, Thomson Brooks, 2007.

REFERENCE BOOKS:
1. K. Thyagarajan, *Engineering Physics*, McGraw-Hill Education (India) Pvt. Ltd, 2016.
2. V. Rajendran*, Engineering Physics,* Tata McGraw Hill Publications Ltd, 7th Edition, New Delhi, 2014.
3. N.K. Verma, *Physics for Engineers,* PHI Pvt. Ltd., 2014.

VIDEO LECTURES:
1. https://nptel.ac.in/courses/115102023
2. https://nptel.ac.in/courses/117102061
3. https://archive.nptel.ac.in/courses/122/107/122107035
4. https://nptel.ac.in/courses/115107095

WEB RESOURCES:
1. http://www.freepdfbook.com/engineering-physics-mcgraw-hill/
2. https://www.vedantu.com/revision-notes/cbse-class-12-physics-notes-chapter-10-wave-optics
3. https://salmanisaleh.files.wordpress.com/2019/02/physics-for-scientists-7th-ed.pdf
4. https://www.researchgate.net/publication/344758634_Short_Notes_on_Engineering_Physics

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22EE102401	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	3	-	2	-	4

Pre-Requisite   –
Anti-Requisite   Fundamentals of Electrical Technology.
Co-Requisite   -

COURSE DESCRIPTION: This course is designed to provide an overview on the fundamentals of electrical and electrical engineering concepts and hands-on experience for non-electrical graduating students. The course address the fundamentals concepts of electrical circuits, operational aspects of motors, transformers and general electrical wiring systems. The course also emphasis on the illumination design, back-up supplies like UPS and Batteries, sensors and transducers, and principles of fundamental electronic devices and their applications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1.   Analyze the electrical circuits by applying the principles of electrical circuits.
CO2.   Understand the operation of various motors used in domestic application, transformers and general wiring schemes.
CO3.   Understand the operational aspects of UPS, batteries and design the appropriate lighting system for various industrial and domestic applications.
CO4.   Understand the principle of various sensor and transducers to sense/measure various non-electrical parameters.
CO5.   Understand the fundamentals of basic electronic devices, their characteristics and applications of electronic devices.
CO6.   Work independently or in teams to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	1	-	-	-	-	-	-	-	-	3	-
CO3	3	2	2	-	-	1	1	-	-	-	-	-	-	-	3	-
CO4	3	1	-	-	-	1	-	-	-	-	-	-	-	-	3	-
CO5	3	1	-	1	2	-	-	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	3	-
Course Correlation Mapping	3	2	1	1	2	1	1	-	3	3	-	-	-	-	3	-

Correlation Levels: **3: High;**   **2: Medium;**   **1: Low**

COURSE CONTENT

Module 1:   **FUNDAMENTALS OF ELECTRIC CIRCUITS**   **(10 Periods)**
Classification of network elements; Voltage-Current relations for passive elements; Kirchhoff's laws; Series-Parallel connection; Mesh and Nodal analysis (With DC Independent Sources only). AC sources–Single loop generator, Phasor representation, Voltage, Current, Impedance, Power factor and Apparent power.

Module 2:   **ELECTRICAL SYSTEMS**   **(09 Periods)**
Motors: Types of motors, working principle and applications—DC motor, Three Phase Induction motor, Synchronous motor, Stepper motor.
Single Phase Transformer: Construction, principle of operation; EMF equation.
Electrical wiring: Methods of electrical wiring systems; Earthing procedure, Switch fuse unit (SFU), Operation of MCB and Relays.

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Module 3: **UTILIZATION OF ELECTRICAL SYSTEMS** **(09 Periods)**
Illumination: Light sources, Terminologies, Laws of illumination; Types of lamps, Lighting calculations; Interior Lighting - Industrial lighting; Exterior lighting- Street lighting and Flood lighting.
Uninterruptible Power Supply (UPS) - Components in UPS, Functionality and Calculation of ratings for UPS components to a specific load.
Emergency supply: Batteries -Types of batteries, Elementary calculations for energy consumption for a specified application.

Module 4: **SENSORS AND TRANSDUCERS** **(08 Periods)**
Sensors- Light sensor, Voltage sensor, Temperature and Humidity sensor, Motion detection sensors, Wireless bluetooth sensors and Distance measurement with Ultrasound sensor.
Transducers -Basic requirements of transducers, Passive transducers - Strain gauge, Hall-Effect transducer, LVDT and Active transducers- Piezoelectric and Thermocouple, Data acquisition system (overview and concept only).

Module 5: **FUNDAMENTALS OF ELECTRONICS ENGINEERING** **(09 Periods)**
Half wave and full wave rectifier, Zener diode, characteristics, application – Regulator. BJT—operation; Introduction to Operational amplifier: Inverting and non-inverting amplifier. Application—Adder, Comparator, Integrator and Differentiator; Analog to Digital Convertors—Flash type and Successive approximation types; Digital to Analog converters—Weighed resistor and R-2R types.

Total Periods: *45*

EXPERIENTIAL LEARNING

LIST OF EXERCISES:
1. Verification of Kirchhoff's laws (Mesh and Nodal Analysis).
2. Performance evaluation by brake test on DC Shunt Motor.
3. Performance evaluation of a 1-Phase Transformer by Load test.
4. Practicing plate and pipe earthing system.
5. Operation and testing of Fuse, MCB and Relays.
6. Design and estimation of wiring for a typical house: One lamp controlled by one switch, Two lamp controlled by two switch and stair case wiring.
7. Calibration of LVDT for linear displacement measurement.
8. Analyze the characteristics of Resistance Temperature Detector (RTD) sensor.
9. Analyze the characteristics of piezoelectric sensor.
10. Investigate ripple factor and load regulations of rectifier with and without filters.
11. Design of inverting and non-inverting amplifiers using op-amp.
12. D-A converter (R-2R ladder) using Op-Amp 741 with required voltage levels.

TEXT BOOKS:
1. Ashfaq Hussain, Fundamentals of Electrical Engineering, Dhanpatrai& Co. (P) Ltd., 3rd Edition, New Delhi, 2009.
2. R. L. Boylestad and Louis Nashelsky, Electronics Devices and Circuits, PHI, 11th edition, 2009.

REFERENCE BOOKS:
1. 1. Wadhwa, C. L. Basic Electric Engineering. 4th Edition, New Age International Private limited.
2. D. Patranabis, Sensors and Transducers, PHI Learning Private Limited, 2nd Edition, 2003.
3. A.K.Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co., 19th Edition, 2015.
4. C.L. Wadhwa, Generation, Distribution and Utilization of Electrical Energy, New Age International Private Limited, 2015.

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VIDEO LECTURES:

1. https://nptel.ac.in/courses/108108076
2. https://nptel.ac.in/courses/108105061
3. https://nptel.ac.in/courses/108108147
4. https://nptel.ac.in/courses/108101091

WEB RESOURCES:

1. https://www.electrical4u.com/electric-circuit-or-electrical-network/
2. https://www.electronicshub.org/dc-circuits-basics/
3. https://www.electrical4u.com/working-of-electric-motor/
4. https://electricalbaba.com/what-is-ups-working-types-of-ups-explained/
5. https://www.lrc.rpi.edu/resources/publications/pdf/illuminationfund.pdf
6. https://www.sitsitamarhi.ac.in/wp-content/uploads/2020/04/file_5e8ef00b06190.pdf
7. https://www.electronics-tutorials.ws/io/io_1.html
8. https://www.homemade-circuits.com/making-ups-tutorial/
9. https://www.engineersgarage.com/introduction-to-uninterruptible-power-supply-ups-and-its-design-part-1-17/
10. https://www.dfliq.net/blog/the-basics-of-electrical-components/

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CS102001	**PROGRAMMING FOR PROBLEM SOLVING**	3	-	2	-	4

Pre-Requisite   -
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on C Programming concepts, Operators and Expressions, Input and Output Functions, Control Structures, Problem Solving Aspects, Arrays and Strings, Functions, Pointers, Structures and Unions, and File Handling.

COURSE OUTCOMES: *After successful completion of the course, students will be able to*:
CO1. Demonstrate knowledge on C programming constructs to develop programs.
CO2. Design algorithms using problem-solving techniques for given problems.
CO3. Apply functions and Arrays to enhance reusability and data manipulation.
CO4. Develop programs using pointers for efficient memory management.
CO5. Apply structures, unions and file handling concepts to develop societal applications.
CO6. Work independently or in team to solve problems with effective communications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	3	2	3	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	3	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	3	-	3	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	3	2	3	3	-	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	3	-
Course Correlation Mapping	**3**	**2**	**3**	**2**	**3**	**3**	-	-	**3**	**3**	-	-	-	-	**3**	-

Correlation Levels: **3: High;**   **2: Medium;**   **1: Low**

COURSE CONTENT

Module 1:   INTRODUCTION TO C PROGRAMMING *(09 Periods)*
Basics of C Programming: Introduction, Structure of a C program, Concept of a variable, Data types in C, Program statement, Declaration, Storing the data in memory, Tokens,Operators and expressions, Lvalues and Rvalues, Type conversion in C.
Input and Output: Basic screen and keyboard I/O in C, Non-formatted input and output, formatted input and output functions.

Module 2:   CONTROL STATEMENTS AND INTRODUCTION TO *(08 Periods)*
**   PROBLEM SOLVING**
Control Statements: Specifying test condition for selection and iteration, Writing testexpression, Conditional execution and selection, Iteration and repetitive execution, gotostatement, Special control statements, Nested loops.
Introduction to Problem Solving: Algorithms, Flowcharts, Problem solving aspect, Top-down design, Implementation of algorithms, program verification and efficiency ofalgorithms.

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Module 3:   ARRAYS & STRINGS AND FUNCTIONS   *(10 Periods)*
Arrays and Strings: One-dimensional array – Declaration, Initialization, Accessing elements, operations; Multi-dimensional arrays – Declaration, Initialization, Working with 2D arrays; Strings – Declaration, Initialization, Printing strings, String input, Character manipulation, String manipulation; Arrays of strings – Initialization, manipulating string arrays.
Functions: Concept of function, Using functions, Call by value mechanism, working with functions, passing arrays to functions, Scope and extent, Storage classes, Recursion.

Module 4:   POINTERS   *(08 Periods)*

Introduction to Pointers: Understanding memory addresses, Address operator (&), Pointer – declaration, Initialization, Indirection operator and dereferencing, Void and Null pointers, Use of pointers, Arrays and pointers, Pointers and strings, Pointer arithmetic, Pointers to pointers, Array of pointers, Pointers to an array, Two-dimensional arrays and pointers, Pointers to functions, Dynamic memory allocation.

Module 5:   USER-DEFINED DATA TYPES AND FILES   *(10 Periods)*
User-Defined Data Types: Structures - Declaration, Accessing the members, Initialization,typedef and its use, Arrays of structures, Arrays within structure, Structures and pointers,Structures and functions; Unions, Enumeration types, Bitfields.
Files: Using files in C, Working with text and binary files, Direct File Input and Output, Files of records, Random access to files of records.

                                                        Total Periods: 45

EXPERIENTIAL LEARNING
1. a) Write a C program to perform the arithmetic operations on two integer numbers.

    b) Write a program to evaluate the following expressions by reading the necessary values from the keyboard.
        i. $(ax + b)/(ax - b)$ ii. $2.5 \log x + \cos 32^0 + | x^2 + y^2|$
        iii. $ax^5 + bx^3 + c$ iv. ae^{kt}

2. a) Write a C program to find the roots of a quadratic equation.

    b) In a town, the percentage of men is 52. The percentage of total literacy is 48 and the total percentage of literate men is 35 of the total population. Write a C program to find the total number of illiterate men and women if the population of the town is 7000.

3. a) Write a C Program to compute an electricity bill based on the following slab rates.

Consumption units	Rate (in Rupees/unit)
0-100	4.0
101-150	4.6
151-200	5.2
201-300	6.3
Above 300	8.0

    (**Hint**: Take current and old meter readings from the user to get consumption units)

    b) An insurance company computes the premium amount based on the following;
        i. If a person's health is excellent and the person is between 25 and 35 years of age and lives in a city, and is a male then the premium is Rs.4 per thousand and the policy amount cannot exceed Rs.2 lakhs.
        ii. If a person satisfies all the above conditions and is female then the premium is Rs.3 per thousand and the policy amount cannot exceed Rs.1 lakh.
        iii. If a person's health is poor and the person is between 25 and 35 years of age and lives in a village and is a male then premium is Rs.6 per thousand and the policy cannot exceed Rs. 10000.
        iv. In all other cases the person is not insured.
            Write a C program to determine whether the person should be insured or not, his/her premium rate and maximum amount for which he/she can be insured.

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c) Write a C Program to find the grade for a student using a Switch case. The user needs to enter a subject score (varies from 0 to 100)and then display the grade as described below.

Score	Grade	Score	Grade
> = 90	O	>=50 to< 60	D
>=80 to< 90	A	>=40 to< 50	E
>=70 to< 80	B	< 40	Fail
>=60 to< 70	C		

4. a) A Fibonacci sequence is defined as follows:
The first and second terms in the sequence are 0 and 1. Sub-sequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first *n* terms of the sequence.

b) Write a C program to find the sum of individual digits of a positive integer.

c) Write a C program to read two numbers *x* and *n*, and then compute the sum of the geometric progression: $1+x+x^2+x^3+\ldots\ldots+x^n$. Show appropriate error message for *n<0*. (*Example*: if *n* is 3 and *x* is 5, then the sum is: 1+5+25+125)

d) Write a C program to print the following pattern.

```
                1
            1   2   1
        1   2   3   2   1
    1   2   3   4   3   2   1
1   2   3   4   5   4   3   2   1
```

5. a) Write a C program to find both the largest and smallest numbers in a list of integers.

b) Write a C program that uses function to perform the following:
i) Addition of Two Matrices   ii) Multiplication of Two Matrices

6. a) Write a C program to insert a sub-string in to a main string at a given position.

b) Write a C program to count the lines, words and characters in a given text.

7. a) Write a C program to generate all the prime numbers between 1 and *n*, where *n* is a value entered by the user. Define a separate function to generate prime numbers.

b) Write C program that uses recursive function to find the following.
i) Factorial of a given integer   ii) GCD of two given integers

8. a) Write a C program to print the elements of an array in reverse order using pointers.

b) Write a C program to count the number of vowels and consonants in a string using pointers.

c) Write a C program to store *n* elements in an array and print the elements in sorted order using pointers.

9. a) Write a C program that performs the following operations:
i. Reading a complex number   ii. Writing a complex number
iii. Addition of two complex numbers   iv. Multiplication of two complex numbers
(**Note:** Represent complex number using a structure.)

b) Define a structure to store employee details include *Employee-Number, Employee-Name, Basic-pay, Date-of-Joining.* Write a C program for the following.
i. A function to store 10 employee details.
ii. A function to implement the following rules while revising the basic pay.
If Basic-pay<=Rs.5000 then increase it by 15%.
If Basic-pay> Rs.5000 and <=Rs.25000 then it increase by10%.
If Basic-pay>Rs.25000 then there is no change in Basic-pay.
iii. A function to print the details of employees whohave completed 20 years of service from the Date-of-Joining.

10 a) Write a C program to reverse the first *n* characters of a given text file.

b) Write a C program to merge two files into a new file.

11 Develop a phone book application to save users contact information include name, mobile number and email id as well as to edit and delete contact details.

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RESOURCES

TEXT BOOKS:

1. PradipDey and Manas Ghosh, *Programming in C*, Second Edition, Oxford University Press, New Delhi, 2013.
2. R. G. Dromey, *How to Solve it by Computer*, First Edition, Pearson Education, 2013.

REFERENCE BOOKS:

1. Byron S Gottfried and Jitender Kumar Chhabra, *Programming with C*, Fourth Edition, McGraw Hill Education, 2019.
2. YashavantKanetkar, *Let Us C*, Fifteenth Edition, BPB Publications, 2017.
3. E. Balagurusamy, *Programming in C*, Seventh Edition, McGraw Hill Education Pvt, Ltd, New Delhi, 2017.
4. Behrouz A. Forouzan and Richard F. Gilberg, *Computer Science: A Structured Programming Approach Using C*, Third Edition, Cengage Learning, 2008.

SOFTWARE/TOOLS:

1. Software: Turbo C++/Dev C++

VIDEO LECTURES:

1. https://www.digimat.in/nptel/courses/video/106105171/L03.html
2. https://nptel.ac.in/courses/106104128

WEB RESOURCES:

1. Learn C Programming - https://www.programiz.com/c-programming
2. Learn C Programming - https://www.tutorialspoint.com/cprogramming/index.htm
3. C Programming Exercises, Practice, Solution - https://www.w3resource.com/c-programming-exercises/
4. Basic programming exercises and solutions in C - https://codeforwin.org/2015/05/ basic-programming-practice-problems.html
5. C Programming Exercises, Practice, Solution - https://www.w3resource.com/c-programming-exercises/
6. Basic programming exercises and solutions in C - https://codeforwin.org/2015/05/basic-programming-practice-problems.html

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22AI105001	**DESIGN THINKING**	-	1	2	-	2

Pre-Requisite	-
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on design thinking process, evaluation of requirement specification and reflections on design experience. This course also focuses on demonstration of five phases of design thinking such as empathize, define, ideate, prototyping, testing and validation with design thinking tools and frameworks.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Investigate the requirements of a problem by conducting surveys.
CO2. Create meaningful and actionable problem statements for creative problem solving.
CO3. Construct blueprints to visualize user attitudes and behavior for gaining insights of customers.
CO4. Design prototypes of innovative products or services for a customer base.
CO5. Develop relevant products or services by choosing good design and applying empathy tools for experiencing user requirements.
CO6. Work independently and communicate effectively in oral and written forms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	3	-	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	1	-	1	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	2		3	-	-	-	-	-	-	1	-	-	-	3	-
CO4	-	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	-	3	-	1	1	-	1	2	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	-	3	3	2	-	-	-	3	-
Course Correlation Mapping	1	3	2	3	1	-	1	2	3	3	2	1	-	-	3	-

Correlation Levels: **3: High;**   **2: Medium;**   **1: Low**

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

Introduction to Design Thinking – Design thinking Process, Definition, Importance, Phases of Design Thinking, Canva Tool.

1. Conduct survey and identify the problem by either individual or group and frame a problem statement using AEIOU (Activities, Environment, Interactions, Objects, Users) framework.

2. Identify demographic or focus group for problem statement and create persona and explicitly define the characteristics of persona using Canva tool.

Emphathize - Role of empathy in design thinking, Purpose of Empathy Map, Empathy Tools – Customer Journey Map, Personas, Coggle Tool.

3. Build a Customer Journey Map (CJM-Before-During-After) and identify touch points for any mock scenario or persona created during last experiment and frame 2-3 questions using HMW (How Might We).

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4. Create an Empathy Map using Coggle design thinking tool.
   **Sample Empathy Map:**

EMPATHY MAP *Example (Buying a TV)*
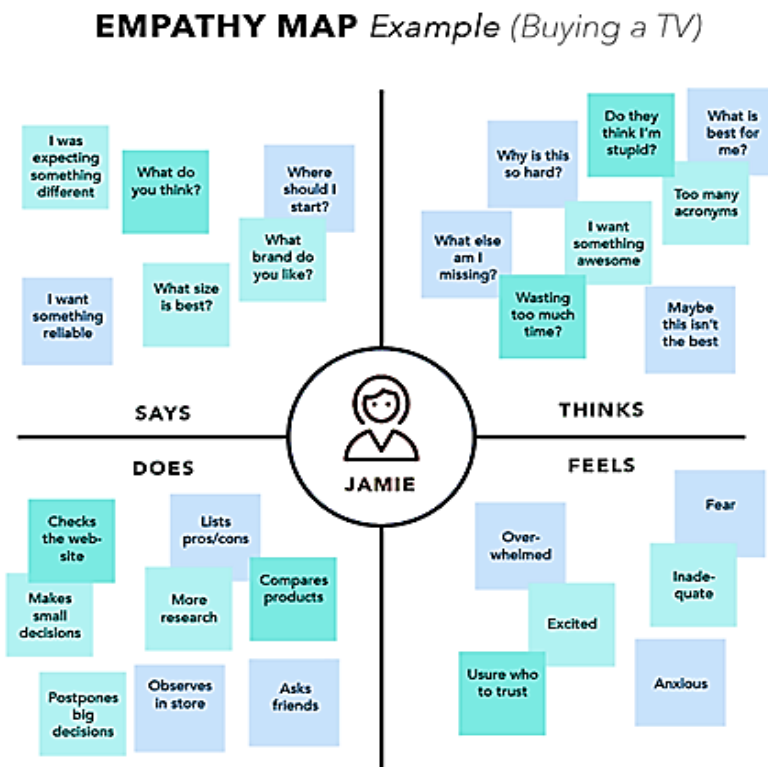
Ideation - Importance of visualizing and empathizing before ideating, Applying the method**,** Ideation Tools - Story board, Brainstorming, Mind Map, SCAMPER.

5. **Story boarding design ideas:** Consider a mock scenario and create user stories and storyboards to transform information about user needs into design concepts using any story board tool.

6. Create Mind Map for your problem statement using Coggle.
   Sample Mind Map:

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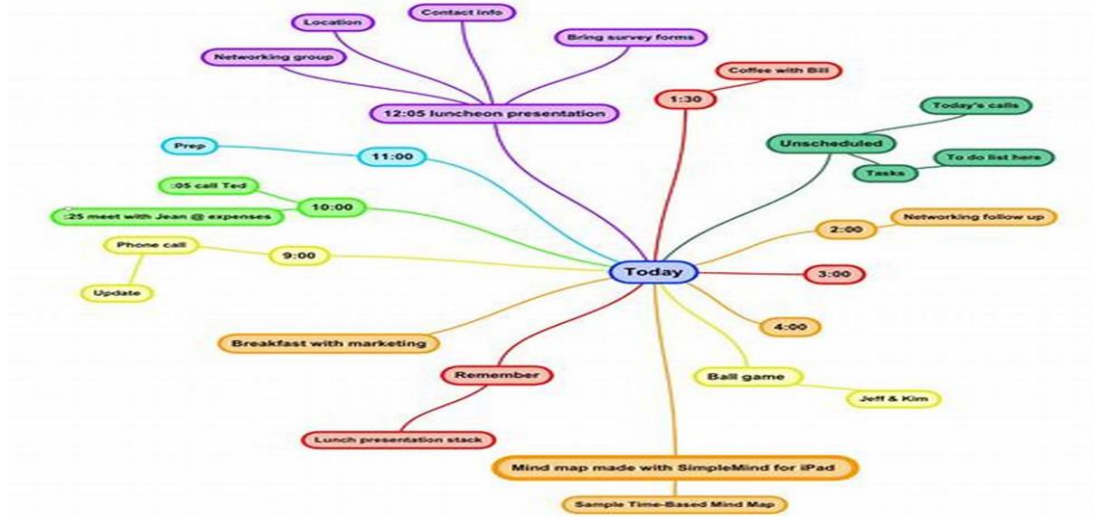
7. Perform Brain Storming Session with your team and record using the SCAMPER framework and finalize the best three innovative ideas.

Prototyping and Testing – Definition, Prototype examples, Need for Prototyping, Fidelity for prototypes, Process of prototyping, Introduction to Marvel POP Software**,** Testing prototypes with users.

8. Create an application prototype for product recommendation using **Marvel POP Software**.

9. Create a **low-fidelity paper prototype** by sketching out the product design and adding relevant functionality.

10. Test the prototype created in Exercise 9 by interacting with each member of the team, walking them through the design and gathering feedback. Use feedback grid with the following quadrants: what worked, what could be improved, questions, and ideas.

What worked?	What could be improved?
Questions	Ideas

RESOURCES:

REFERENCES:

1. Michael G. Luchs, Scott Swan , Abbie Griffin, "Design Thinking – New Product Essentials from PDMA",Wiley,2015.
2. Vijay Kumar, "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization", 2012.
3. Kathryn McElroy,"Prototyping for Designers: Developing the best Digital and Physical Products",O'Reilly,2017.
4. S.Salivahanan, S.Suresh Kumar, D.Praveen Sam, "Introduction to Design Thinking",Tata Mc Graw Hill, First Edition,2019.

SOFTWARE/TOOLS:

1. Canva (https://www.canva.com/)
2. Coggle (https://coggle.it/)
3. Marvel POP

VIDEO LECTURES:

1. https://nptel.ac.in/courses/109/104/109104109/
2. https://nptel.ac.in/courses/110106124/
3. https://www.youtube.com/watch?v=q654-kmF3Pc&t=0s
4. https://www.youtube.com/watch?v=TNAdanuvwtc
5. https://www.youtube.com/watch?v=U-hzefHdAMk
6. https://www.youtube.com/watch?v=zbLxs6te5to

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WEB RESOURCES:

1. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process
2. https://www.ibm.com/design/thinking/page/toolkit
3. https://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-by-creating-your-point-of-view-and-ask-how-might-we
4. https://www.culturepartnership.eu/en/article/ten-tools-for-design-thinking
5. https://www.mindtools.com/pages/article/newCT_02.htm

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CB111001	**INTERNSHIP**	-	-	-	-	2

Pre-Requisite -

Anti-Requisite

Co-Requisite -

COURSE DESCRIPTION: This couse provides an exposure to the industrial environment; Create competent professionals for the industry; sharpen the real time technical / managerial skills required at the job; Gain professional experience and understand engineer's responsibilities and ethics; Familiarize with latest equipment, materials and technologies; Gain exposure to technical report writing; Gain exposure to corporate working culture.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze latest equipment, tools and technologies that are used in industry to solve complex engineering problems following relevant standards, codes, policies and regulations.

CO2. Analyze safety, health, societal, environmental, sustainability, economical and managerial factors considered in industry in solving complex engineering problems.

CO3. Perform individually or in a team besides communicating effectively in written, oral and graphical forms on practicing engineering.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	-	3	-	-	-	3	3	-	3	-
CO2	-	3	-	-	-	3	3	-	-	-	3	-	3	-	3	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-	3	-	3	-
Course Correlation Mapping	3	3	3	3	3	3	3	3	3	3	3	3	3	-	3	-

Level of Correlation: 3 - High   2 - Medium   1 - Low

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CB108001	**CAPSTONE PROJECT**	-	-	-	-	10

Pre-Requisite -
Anti-Requisite
Co-Requisite -

COURSE DESCRIPTION: This course enables Identification of topic for the project work; Literature survey; Collection of preliminary data; Identification of implementation tools and methodologies; Performing critical study and analysis of the topic identified; Time and cost analysis; Implementation of the project work; Preparation of thesis and presentation.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Create/Design algorithms and software to solve complex Computer Science, Information Technology and allied problems using appropriate tools and techniques following relevant standards, codes, policies, regulations and latest developments.

CO2. Consider society, health, safety, environment, sustainability, economics and project management in solving complex Computer Science, Information Technology and allied problems.

CO3. Perform individually or in a team besides communicating effectively in written, oral and graphical forms on Computer Science and Information Technology based systems or processes.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	-	3	-	-	-	3	3	3	3	3
CO2	-	3	-	-	-	3	3	-	-	-	3	-	3	3	3	3
CO3	-	-	-	-	-	-	-	-	3	3	-	-	3	3	3	3
Course Correlation Mapping	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Level of Correlation: 3 - High   2 - Medium   1 - Low

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SCHOOL CORE

(Language Basket)

Course Code	Course Title	L	T	P	S	C
22LG102401	**ENGLISH FOR PROFESSIONALS**	2	-	2	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course deals with listening strategies, reading comprehension, grammar, vocabulary, pronunciation, Written, Verbal and Non-verbal communication, Channels of communication, Barriers to communication, Modes of technology-based communication, and Technical Communication

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the basics of Reading, Writing, Listening, and Speaking skills.

CO2. Analyze the rules of English grammar in speaking and writing.

CO3. Demonstrate knowledge of English pronunciation in speaking.

CO4. Apply the knowledge of reading strategies and vocabulary in communication.

CO5. Apply the strategies of writing in preparing a report.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	3	-	2
CO2	-	3	2	-	-	-	-	-	-	3	-	2
CO3	3	2	-	-	-	-	-	-	-	3	-	2
CO4	-	-	-	-	3	-	-	-	-	3	-	2
CO5	-	-	-	-	3	-	-	-	-	3	-	2
Course Correlation Mapping	**3**	**2**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**2**

Correlation Levels: 3: High;   2: Medium;   1: Low

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COURSE CONTENT

Module 1:   SUPER HEROES – THE SCIENCE BEHIND SUPER HEROES   *(06 Periods)*

Reading for Comprehension, Grammar, Speaking, Listening, Vocabulary, Writing, Verbal and Non-verbal communication.

Module 2:   ALIENS – THE CYLINDER OPENS   *(06 Periods)*

Reading for comprehension, Grammar, Vocabulary, Writing, Listening, and Channels of communication.

Module 3:   INVENTORS – THE RAMAN EFFECT   *(06 Periods)*

Reading comprehension, Listening, Writing, Grammar, Speaking, Pronunciation, and communication barriers.

**Module 4:   HEALTH AND NUTRITION – WHAT SHOULD YOU BE   *(06 Periods)*
                EATING**

Reading comprehension, Listening, Speaking, Grammar,Writing, Pronunciation, and Modes of technology-based communication.

**Module 5:   NEW-AGE ENTREPRENEURS – HOW A CHINESE   *(06 Periods)*
                BILLIONAIRE BUILT HER FORTUNE**

Reading comprehension, Vocabulary, Listening, Grammar, Writing, and Technical Communication

Total Periods: 30

EXPERIENTIAL LEARNING
PART-A
Any six modules among the following:
1.   Conversation starters and role play

2.   Reading comprehension

3.   Listening comprehension

4.   Vocabulary Building (business and job-related vocabulary)

5.   Describing people, places, objects, and Events

6.   Phonetics - Accent/ Rhythm/ Intonation

7.   Tenses

8.   Proposal Writing

PART-B
Any four modules among the following:
1.   Communicating effectively is important to become successful in any business. Prepare a Case study of successful business personnel regarding communication competence.

2.   Prepare a PowerPoint presentation on an orator and analyze the voice dynamics.

3.   People face situations to convince or agree with the points they have. The college arranges a 5-day tour program to Goa. Prepare a video on persuasive talk and convince parents to get

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permission.

4. Write an article on the famous clichés of our time.

5. Prepare a poster on the effects of social media on youth.

6. Give a short talk on the importance of inventors and their role in present socio, political and economic changes.

7. Prepare a collage of entrepreneurs' pictures and their achievements.

8. NASA released recent photos of the universe with the help of the James Webs Space Telescope. Write down the expected impact on the existing theory on planets and the universe.

9. Obesity is the most common problem for people. List out the reasons for the problem and prepare food habits to overcome.

10. Epics of India deals with superheroes of those days. Compare the weapons used in the battles of Mahabharata with modern weapons.

11. Write a report on your recently invented product so that it should be sold as a hot cake in the market.

12. Illustrate the essential rules for good precis writing.

RESOURCES

TEXT BOOK:
1. N.P. Sudharshana & C.Savitha, "*English for Technical Communication*", Cambridge University Press. 2016.

REFERENCE BOOKS:
1. Kline, J. A. "*Speaking effectively: Achieving excellence in presentations. Upper Saddle River*", NJ: Pearson/Prentice Hall, 2004.
2. Kuiper, "*S. Contemporary business report writing*" (3rd ed.). Cincinnati, OH: Thomson/South,Western, 2007.
3. Locker, K. O. & Kaczmarek, "*S. K. Business communication*": Building critical skills (3rd ed.). New York: McGraw,Hill/Irwin, 2007.
4. Mascull, "*B. Business vocabulary in use: Advanced. Cambridge*": Cambridge University Press, 2004.
5. Matthews, C. B. & Matthews, and M. Quicksteps to winning business presentations: Make the most of your PowerPoint presentations. New York: McGraw,Hill, 2007.
6. Marsh, C. Strategic writing: Multimedia writing for public relations, advertising, sales and marketing, and business communication. Boston: Pearson/Ally and Bacon, 2005.
7. Munter, M. & Russell, L. Guide to presentations. (2nd ed.). Upper Saddle River: NJ: Pearson/Prentice Hall, 2008.
8. Reardon, K. K. The skilled negotiator: Mastering the language of engagement. San Francisco: Jossey,Bass, 2004.
9. Stiff, J. B. Persuasive communication (2nd ed.). New York: Guilford Press. Engagement. San Francisco: Jossey, Bass, 2003.
10. Stiff, J. B. Persuasive communication (2nd ed.). New York: Guilford Press, 2003.

VIDEO LECTURES:
1. https://learnenglish.britishcouncil.org/general,english/video,zone/the,day,elizabeth,became, queen
2. https://www.youtube.com/watch?v=CscHc8qSn1A

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WEB RESOURCES:

1. https://galgotiacollege.edu/assets/pdfs/study,material/Notes,english.pdf
2. https://lecturenotes.in/subject/183
3. https://www.fluentu.com/blog/english/professional,english/
4. https://learnenglish.britishcouncil.org/business,english

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG105402	**SOFT SKILLS**	-	-	2	-	1

Pre-Requisite -
Anti-Requisite -
Co - Requisite -

COURSE DESCRIPTION: This course deals with an understanding of the fundamental soft skills and their practical social and workplace usage. It helps participants to communicate effectively and to carry themselves confidently and in harmony with their surroundings. They also learn how to identify and overcome the barriers in interpersonal relationships, and to employ oral and written communication, teamwork, leadership, problem-solving, and decision-making skills, to gain the best results.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge of career skills by analyzing the strategies of Goal Setting, Thinking Skills, interpersonal skills, and etiquette.

CO2. Analyzevarious situations by applying Assertive communication and Non-verbal forms in developing Interpersonal Skills.

CO3. Apply appropriate managerial strategies by analyzing the conflicts in various situations.

CO4. Demonstrate various communication styles by analyzing and applying Thinking Skills in diverse teams as an individual and a team member and during Interviews and Group Discussions.

CO5. Analyze and apply appropriate strategies of emotional intelligence and adaptability skills for personal and professional success.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	-	2	-	2	-	-	-	-	2
CO2	3	3	2	-	2	-	2	-	-	2	-	2
CO3	2	2	2	-	3	-	2	-	-	-	-	2
CO4	3	2	2	-	2	-	2	-	3	2	3	2
CO5	2	2	2	-	3	-	3	-	-	2	-	3
Course Correlation Mapping	**3**	**2**	**2**	**-**	**3**	**-**	**2**	**-**	**3**	**2**	**3**	**2**

Correlation Levels: 3: High; 2: Medium; 1: Low

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EXPERIENTIAL LEARNING
OURSE CONTENT
***Any ten modules are mandatory among the following:**

Module 1:   BODY LANGUAGE

Body language basics, Types of Body Language, Facial Expressions and their messages, Eye Contact Insights, Body Posture, Hand gestures, and finger movements

Module 2:   ASSERTIVENESS

Communication Styles, Benefits, Asserting yourself, Tips, and Role Play

Module 3:   GOALSETTING

Seven Steps of Goal Setting, Self-Motivation, Personal Goal Setting, and Setting Career Goals

Module 4:   THINKING SKILLS

Positive Thinking, Creative Thinking, Lateral Thinking, Logical Thinking, and Intuitive Thinking

Module 5:   TEAM BUILDING

Learning Activities, Management Essentials, and Team Building Scenarios

Module 6:   CONFLICT MANAGEMENT

Ways of Resolving Conflict, Personality Types and Conflict, Conflict Resolution Process, and Team Conflict

Module 7:   EMOTIONAL INTELLIGENCE

Definition, understanding emotions, Identifying emotional intelligence, and self-assessment

Module 8:   ADAPTABILITY SKILLS

Understanding organizational communication, Identifying adaptability skills, and self-assessment.

Module 9:   GROUP DISCUSSIONS

Types of GD, Dos, and Don'ts, Dynamics of GD, Intervention, and Summarization Techniques

Module 10:   INTERVIEW SKILLS

Planning, Opening Strategies, Answering Strategies, Teleconferencing, Videoconferencing, Practice questions, and Dress code

Module 11:   INTERPERSONAL SKILLS

Starting a Conversation, Responding to a Conversation, Conversation Examples, Body Language, and Role Play

Module 12:   ETIQUETTE

Basic Social Etiquette, Telephone Etiquette, Dining Etiquette, Conference Etiquette, and Email Etiquette

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RESOURCES

REFERENCES:
1. Manual…
2. Dr. K. Alex, *Soft Skills*, S. Chand & Company LTD, Latest Edition, New Delhi, 2018.
3. R. C. Sharma & Krishna Mohan, *Business Correspondence and Report Writing*, Tata McGraw,Hill Publishing Company Limited, 3rd Edition, New Delhi, 2012.
4. S.P. Dhanavel, English and Soft Skills, Orient Black Swan Private Limited, 2010.

SOFTWARE/TOOLS:
1. K-VAN Solutions.
2. Learning to Speak English 8.1, The Learning Company, 4 CDs.
3. English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
4. Language in Use 1, 2 & 3.
5. Cambridge Advanced Learner's Dictionary, 3rd Edition.
6. Let's Talk English, Regional Institute of English South India

VIDEO LECTURES:
1. http://nptel.ac.in/courses/106102064
2. http://nptel.ac.in/courses/106106127/

WEB RESOURCES:
1. http://psydilab.univer.kharkov.ua/resources/ucheba/softskills/Chapter_1_Introduction.PDF
2. https://learning.tcsionhub.in/courses/tcs,ion/introduction,to,soft,skills/
3. https://goo.gl/laEHOY (dealing with complaints)
4. http://www.adm.uwaterloo.ca/infocecs/CRC/manual/resumes.html
5. https://goo.gl/FEMGXS
6. http://www.career.vt.edu/interviewing/TelephoneInterviews.html
7. http://job,search,search.com/interviewing/behavioral_interviews
8. https://www.thebalancecareers.com/what,are,soft,skills,2060852

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG101403	**GERMAN LANGUAGE**	2	-	-	-	2

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Oral communication; Basic grammar; Basic writing; Berufsdeutcsch (Business German)

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate basic knowledge of the German language and verb conjugation.

CO2. Comprehend and apply the knowledge of vocabulary and phrases in day-to-day real-life conversation.

CO3. Apply the various sentence structures by examining the rules of grammar in speaking and writing.

CO4. Analyze the various verb structure of English and German languages effectively in professional writing

CO5. Apply the various verb structure of English and German languages effectively in professional writing

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	2	-	-	-	-
CO2	3	-	-	-	-	-	-	2	-	-	-	-
CO3	3	-	-	-	-	-	-	2	-	-	-	-
CO4	3	-	-	-	-	-	-	2	-	-	-	-
CO5	3	-	-	-	-	-	-	2	-	-	-	-
Course Correlation Mapping	3	-	-	-	-	-	-	2	-	-	-	-

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1: INTRODUCTION   *(06 Periods)*

Introduction - German alphabet, numbers, days in a week, names of months, seasons. Grammar: Nouns –(i)Nominative case and (ii) Nominative personal pronouns, simple sentence, Verb Conjugation 1st and 2nd type, verb Conjugation 3rd type, 'Wh' questions (simple sentences) Nominative (definite and indefinite) Articles

Module 2: CITY AND FOOD   *(06 Periods)*

In the city: naming places and buildings, means of transport, basic directions. Food: drink, groceries and meals. Apartments: rooms, furniture, colours.
Grammar: Nouns-articles negation–(kein and nicht); imperative and the accusative case; Nominative Possessive Pronouns.

Module 3: DAY-TO-DAY CONVERSATIONS   *(06 Periods)*

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Everyday life, telling time, making appointments, leisure activities, and celebrations. Different types of professions, Health and the body, holidays and weather, Clothes and

Module 4:   BASIC GRAMMAR   *(06 Periods)*

Grammar: Possessive articles, Prepositions (am, um, von. bis); Modal verbs, Separable verbs, accusative, past tense of 'to have' and 'to be', imperative sentences, dative case, perfect tense.

Module 5:   BASIC WRITING   *(06 Periods)*

Translation from English to German and German to English, Contacts, Writing letters and Email Writing.

Total Periods: 30

EXPERIENTIAL LEARNING

1.   Prepare a report on the importance of the German language in India
2.   Why is German taught in Indian schools?
     (Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXTBOOKS:

1.   Stefanie Dengler, Paul Rusch, Helen Schmitz, Tana Sieber, *Netzwerk Deutsch als Fremdsprache, Arbeitsbuch A1*, Goyal Publishers and Distributors Pvt. Ltd. 2015.

VIDEO LECTURES:

1.   https://www.youtube.com/watch?v=o4GvYa-3BmY
2.   https://www.youtube.com/watch?v=mrF9BizWmgk
3.   https://www.youtube.com/watch?v=mojirClzQEs
4.   https://www.youtube.com/watch?v=0osSyX0MmCM
5.   https://www.youtube.com/watch?v=mMDOtG5ucHA

WEB RESOURCES:

1.   https://learngerman.dw.com/en/beginners/c-36519789
2.   https://storylearning.com/learn/german/german-tips/basic-german-phrases
3.   https://study.com/academy/lesson/how-to-write-a-letter-in-german.html

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG101404	**FRENCH LANGUAGE**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Oral communication; Basic writing; Basic grammar

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate basic knowledge of the French language.

CO2. Comprehend and apply the knowledge of the alphabet in day-to-day real-life conversation.

CO3. Apply the various styles of greetings in speaking and writing.

CO4. Analyze the various conversations in French languages

CO5. Apply the French words for date and time.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	2	-	-	-	-
CO2	3	-	-	-	-	-	-	2	-	-	-	-
CO3	3	-	-	-	-	-	-	2	-	-	-	-
CO4	3	-	-	-	-	-	-	2	-	-	-	-
CO5	3	-	-	-	-	-	-	2	-	-	-	-
Course Correlation Mapping	3	-	-	-	-	-	-	2	-	-	-	-

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION   *(06Periods)*

Introduction – Introduction, History of the French Language, Extent of the French Language, Reasons To Learn French, Book Organization, Learning French, Advice on Studying French

Module 2:   THE ALPHABET   *(06 Periods)*

Letters, Punctuation, Acute Accent, Grave Accent, Tonic Accent, Stress

Module 3:   GREETINGS   *(06 Periods)*

Greetings, Good-byes, Names, Vous vs. tu, Courtesy, Formal Speech Titles, Asking For One's Name

Module 4:   CONVERSATIONS & NUMBERS   *(06 Periods)*

How are you?, Asking How One Is Doing,
Cardinal Numbers and Ordinal Numbers

Module 5:   THE DATE & TIME   *(06 Periods)*

Numbers 01-31, Seasons, Days of the week, Months of the Year, Numbers 30-60, Times of Day, Asking for the time.

Total Periods: 30

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EXPERIENTIAL LEARNING

1. Prepare a report on the importance of the French language in India
2. Why is French taught in Indian schools?
   (Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXTBOOKS:

1. The current, editable version of this book is available in Wikibooks, the open-content textbooks collection, at http://en.wikibooks.org/wiki/French

VIDEO LECTURES:

1. https://www.bing.com/videos/riverview/relatedvideo?&q=video+lecture+on+THE+ALPHABET+in+french&qpvt=video+lecture+on+THE+ALPHABET+in+french&mid=D123409C16604E0FDE26D123409C16604E0FDE26&&FORM=VRDGAR
2. https://www.youtube.com/watch?v=hd0_GZHHWeE

WEB RESOURCES:

1. https://vdocument.in/french-lecture-notespdf.html?page=2

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG102402	**EMPOWERING YOUR ENGLISH**	2	-	2	-	3

Pre-Requisite   -

Anti-Requisite   22LG102401-English for Professionals

Co-Requisite   -

COURSE DESCRIPTION: This course deals with listening strategies, reading comprehension, grammar, vocabulary, pronunciation, Written, Verbal and Non-verbal communication, Channels of communication, Barriers to communication, Modes of technology-based communication, and Technical Communication

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO6. Develop skills and techniques to speak and write with cohesion.

CO7. Understand the usage of English grammar in speaking and writing.

CO8. Demonstrate knowledge of right pronunciationin speaking.

CO9. Apply the knowledge to build vocabulary in communication.

CO10. Apply the strategies of writing in preparing a report and Email.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	3	-	2
CO2	-	3	2	-	-	-	-	-	-	3	-	2
CO3	3	2	-	-	-	-	-	-	-	3	-	2
CO4	-	-	-	-	3	-	-	-	-	3	-	2
CO5	-	-	-	-	3	-	-	-	-	3	-	2
Course Correlation Mapping	3	2	2	-	3	-	-	-	-	3	-	2

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT

Module 1:   A TIME TO REMEMBER   *(06 Periods)*

Reading for Comprehension, Tenses, Speaking, Listening, Vocabulary, Writing - Email, Verbal and Non-verbal communication.

Module 2:   TIME FOR CHANGE   *(05 Periods)*

Reading for comprehension, Degrees of Comparison, Vocabulary, Listening.

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Module 3: ULTRA MARATHON *(05 Periods)*

Reading comprehension, Listening, Vocabulary of sports, Pronunciation, speaking – Talk about favourite sport.

Module 4: HOTEL RESERVATIONS AND EXPENSES *(08 Periods)*

HOTEL RESERVATIONS:
Reading comprehension – reading reviews, Speaking – calling to check into a hotel, make enquiries, framing questions, Grammar, Writing – writing reviews, Pronunciation.
EXPENSES:
Reading comprehension- analysing data, Vocabulary, Listening, Grammar - Tenses, Writing – writing a report. Speaking – Talk about making daily budget.

Module 5: BODY LANGUAGE *(06 Periods)*

Reading comprehension, Vocabulary, Listening, Grammar, Speaking – Talking about importance of body language, giving mini presentations.

Total Periods: 30

EXPERIENTIAL LEARNING
PART-A
Any six modules among the following:

1. Conversation starters and role play

2. Reading comprehension

3. Listening comprehension

4. Vocabulary Building (business and job-related vocabulary)

5. Describing people, places, objects, and Events

6. Phonetics - Accent/ Tone/ Intonation

7. Grammar

8. Email Writing

PART-B
Any four modules among the following:

1. Identifying induvial strengths and weaknesses raises self-awareness. Do a SWOT analysis and come up with an action plan to present in the classroom.

2. Prepare a sales pitch of your dream product/ app and explain USP.

3. "Gen -Z is a difficult generation". Do you agree with this statement? Tell why and how different Gen Z is.

4. Write an email to your Teacher of English explaining how a construction site near by is creating a hindrance to your learning.

5. Prepare a poster on the effects of social media on youth.

6. Give a short talk on the advantages and disadvantages of social media.

7. What are your thoughts on Mission Mars? Why do you think nations are investing heavily on this? Debate

8. Explain the downside of the development of current era.

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9. Skills, Experience and education – which of these play an important role in life and why? Present your views

10. Talk about a time when you tried a weird / Awesome food. Describe your experience

11. Write an article on your experience of education. What are your recommendations to improve the system?

RESOURCES

TEXTBOOK:
Jack C Richards, "*Interchange Fourth Edition*", Cambridge University Press. 2016.

REFERENCE BOOKS:

1. Kline, J. A. "*Speaking effectively: Achieving excellence in presentations. Upper Saddle River*", NJ: Pearson/Prentice Hall, 2004.

2. Kuiper, "*S. Contemporary business report writing*" (3rd ed.). Cincinnati, OH: Thomson/South,Western, 2007.

3. Locker, K. O. &Kaczmarek, "*S. K. Business communication*": Building critical skills (3rd ed.). New York: McGraw,Hill/Irwin, 2007.

4. Mascull, "*B. Business vocabulary in use: Advanced. Cambridge*": Cambridge *University* Press, 2004.

5. Matthews, C. B. & Matthews, and M. *Quicksteps to winning business presentations: Make the most of your PowerPoint presentations*. New York: McGraw,Hill, 2007.

6. Marsh, C. *Strategic writing: Multimedia writing for public relations, advertising, sales and marketing, and business communication*. Boston: Pearson/Ally and Bacon, 2005.

7. Munter, M. & Russell, L. *Guide to presentations*. (2nd ed.). Upper Saddle River: NJ: Pearson/Prentice Hall, 2008.

8. Reardon, K. K. *The skilled negotiator: Mastering the language of engagement*. San Francisco: Jossey,Bass, 2004.

9. Stiff, J. B. *Persuasive communication* (2nd ed.). New York: Guilford Press, 2003.

10. N.P. Sudharshanaand C.Savitha, *English for Technical Communication*, Cambridge University Press. 2016

VIDEO LECTURES:

1. https://learnenglish.britishcouncil.org/general,english/video,zone/the,day,elizabeth,became,queen

2. https://www.youtube.com/watch?v=CscHc8qSn1A

WEB RESOURCES:

1. https://galgotiacollege.edu/assets/pdfs/study,material/Notes,english.pdf

2. https://lecturenotes.in/subject/183

3. https://www.fluentu.com/blog/english/professional,english/

4. https://learnenglish.britishcouncil.org/business,english

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM101403	**CALCULUS AND TRANSFORMATION TECHNIQUES**	3	-	-	-	3

Pre-Requisite   -
Anti-Requisite   Transformation Techniques and Linear Algebra
Co-Requisite   -

COURSE DESCRIPTION: This course consists of topics in Calculus and Transformation Techniques with applications to various engineering problems. It covers the topics, Mean Value Theorems, Taylor's and Maclaurin's Theorems. It includes functions of two or more variables together with their applications. This course is designed to train students with the basic integral transform techniques.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Make use of mean value theorems to solve engineering problems.

CO2. Identify the maxima and minima of multivariable functions.

CO3. Determine Laplace transform of different functions arising in engineering problems.

CO4. Apply Laplace transform and its inverse to solve initial and boundary value problems.

CO5. Determine the Fourier series and Fourier transforms of various functions.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	-	1	1	-	-	-	-	-	-	-
CO2	3	3	-	1	1	-	-	-	-	-	-	-
CO3	3	2	-	2	1	-	-	-	-	-	-	-
CO4	3	3	-	3	1	-	-	-	-	-	-	-
CO5	3	3	-	3	1	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**-**	**2**	**1**	**-**	**-**	**-**	-	**-**	**-**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

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COURSE CONTENT

Module 1:   SINGLE VARIABLE CALCULUS   *(08 Periods)*

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof) related problems.

Module 2:   MULTIVARIABLE CALCULUS   *(07 Periods)*

Introduction to function of several variables, Jacobian and its properties, Functional dependence, Maxima and minima of functions with two variables, Lagrange's multiplier method.

Module 3   LAPLACE TRANSFORMS   *(10 Periods)*

Definition of Laplace transform, Existence conditions, Laplace transforms of standard functions, Linearity property, First and second shifting theorems, Change of scale property, Laplace transforms of derivatives and integrals, Multiplication by t^n, Division by t, Laplace transform of periodic functions (without proofs), Laplace transforms of unit step function and unit impulse function.

Module 4   INVERSE LAPLACE TRANSFORMS   *(10 Periods)*

Definition of inverse Laplace transform, Linearity property, First and second shifting theorems, Change of scale property, Inverse Laplace transforms of derivatives and integrals, Multiplication by s, Division by s, Convolution theorem (without proofs), Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients.

Module 5   FOURIER SERIES AND FOURIER TRANSFORMS   *(10 Periods)*

Fourier series: Determination of Fourier coefficients, Euler's formulae, Convergence of Fourier series (Dirichlet's conditions), Fourier series in $(-\pi, \pi)$, Half range sine and cosine expansions, Parseval's identity in $(0, \pi)$.

Fourier Transforms: Complex Fourier transform, Fourier sine and cosine transforms, Inverse Fourier transforms.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Obtain the Taylor series of any Single variable function (Algebraic or Transcendental) and then plot the graph of the function given using MAPLESOFT or MATLAB.

2. A 100-gm mass is suspended from a spring with constant 50 N/m. It is set into motion by raising it 10 cm above its equilibrium position and giving it a velocity of 1 m/s downward. During the subsequent motion a damping force acts on the mass and the magnitude of this force is twice the velocity of the mass. If an impulse force of magnitude 2 N is applied vertically upward to the mass at t = 3 s, find the position of the mass for all time**.**
3. Differentiate the Fourier and Laplace transforms of any time domain function with an example**.**

    (It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

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RESOURCES

TEXT BOOKS:

1. B. S. Grewal, *Higher Engineering Mathematics*, Khanna publishers, 44th edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th edition, 2011.

REFERENCE BOOKS:

1. B. V. Ramana, *Higher Engineering Mathematics*, Tata McGraw hill, 1st edition, 2017.
2. N.P. Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/111105121(Calculus)
2. https://nptel.ac.in/111106139/ (Laplace Transform)
3. https://nptel.ac.in/courses/111106111/ (Fourier Series and Fourier Transforms)

WEB RESOURCES:

1. http://www.efunda.com/math/math_home/math.cfm
2. http://www.sosmath.com/
3. http://www.mathworld.wolfram.com/

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM101401	**MATRIX THEORY AND LINEAR ALGEBRA**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a discussion on matrix factorizations, linear systems, Eigenvalues and Eigenvectors, vector spaces, linear transformations, and orthogonality.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the concepts of matrix factorizations and solutions of the linear system.

CO2. Determine the Eigenvalues and Eigenvectors of the matrix and implement the concept of Eigen values and decompositions of a matrix in intelligent systems.

CO3. Apply the concepts of vector spaces and linear transformation on problems of computational systems.

CO4. Use the inner product spaces for the study of orthogonality and to construct orthonormal basis.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3		3	2	-	-	-	-	-	-	-	-	2	-	-
CO2	2	3		2	2	-	-	-	-	-	-	-	-	2	-	-
CO3	3	3	-	2	1	-	-	-	-	-	-	-	-	2	-	-
CO4	2	3		3	2	-	-	-	-	-	-	-	-	2	-	-
Course Correlation Mapping	3	3	-	3	2	-	-	-	-	-	-	-	-	2	-	-

Correlation Levels: *3: High;* *2: Medium;* *1: Low*

COURSE CONTENT

Module 1: MATRICES AND LINEAR SYSTEM OF EQUATIONS *(10 Periods)*
Elementary Row-operations, Elementary Matrices, Echelon form, Rank of a matrix by row-reduction, Solutions of system of linear equations by row reduction, Matrix Factorization, LU factorization, LDU factorization.

Module 2: EIGEN VALUES, EIGEN VECTORS AND *(09 Periods)*
DIAGONALIZATION
Characteristic equation of a matrix, Eigenvalues and Eigenvectors of matrices, Similarity of matrices, Diagonalization by using Eigenvalues, Cayley-Hamilton Theorem (Without Proof), Evaluation of matrix powers.

Module 3: VECTOR SPACES *(10 Periods)*
Vector spaces, Sub-spaces, Four fundamental subspaces of a matrix, Span, Linearly independent and dependent, Basis, construction of Basis, dimensions, Finite dimensional vector space.

Module 4: LINEAR TRANSFORMATION *(08 Periods)*

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Linear transformation, Kernal and range of linear transformation, Basic properties, Invertible linear transformation, Matrix of linear transformation.

Module 5: INNER PRODUCT SPACES   *(08 Periods)*
Inner product, Norm, Distance, Inner product space, Orthogonal and orthonormal basis, Gram-Schmidt orthogonalization, Singlular Value Decomposition for square matrices.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Let Breakfast consists of orange juice, cereal, and eggs with the following nutritional information:

	OJ	Cereal	Eggs
Protein	0%	10%	20%
Vitamin C	20%	15%	0%
Calories	100	120	100

   If you must have 30% protein, 30% Vitamin C and 300 calories for your breakfast, How many servings of OJ, Cereal, and Eggs should you have?
2. Solve for the Eigen values and Eigen vectors of 2x2 matrix on paper and larger matrices using MATLAB.
3. Check that the complex numbers $\square = \{x + iy / i^2 = -1, x, y \in \Re\}$, satisfy all of the conditions in the definition of vector space over $\square$. Make sure you state carefully what your rules for vector addition and scalar multiplication.

(It's an indicative one. The course instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXT BOOKS:
1. Peter Selinger, Matrix theory and linear algebra, 1st Edition, creative commons license, 2018.
2. Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, Linear Algebra, Pearson Education, 5th Edition, 2022.

REFERENCE BOOKS:
1. Kuladeep Sing, Linear Algebra step by step, 1st edition, Oxford University press, 2014.
2. David Poole, *Linear Algebra: A Modern Introduction*, Brooks/Cole, 2nd edition, 2005.
3. Edgar G. Goodaire, Linear Algebra, Cambridge University Press, 1st Edition, 2014.
4. M. Thamban Nair and Arindama Singh, Linear Algebra, Springer, 1st Edition, 2019.
5. Hans Schneider and George Phillip Barker, Matrices and Linear Algebra, Dover Publications, 2nd Edition, 1989.
6. Jim Defranza, Daniel Gagliardi,Introduction to Linear algebra with applications, Mc GrawHill, 2009.

VIDEO LECTURES:
1. https://nptel.ac.in/courses/111106051
2. https://nptel.ac.in/courses/111106135

WEB RESOURCES:
1. https://catalogimages.wiley.com/images/db/pdf/9781119570271.excerpt.pdf
2. https://web.northeastern.edu/dummit/docs/linalgprac_5_eigenvalues_and_diagonalization.pdf
3. https://web.auburn.edu/holmerr/2660/Textbook/vectorspace-print.pdf
4. https://textbooks.math.gatech.edu/ila/linear-transformations.html
5. https://linear.axler.net/InnerProduct.pdf

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM101405	**NUMERICAL METHODS, PROBABILITY AND STATISTICS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course contains various numerical methods to solve algebraic and transcendental equations and differential equations. This course also contains probability distributions and interpretation of hypothesis test for large and small samples.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Determine the approximate root of an equation and apply different methods to compute the value of interpolating polynomial at given point.

CO2 Evaluate integrals making use of quadrature formulae and solve ordinary differential equations numerically.

CO3 Use discrete and continuous distribution models to calculate probabilities for appropriate random variables.

CO4 Demonstrate and apply the basic concepts of inferences concerning means and proportions to the decision making process.

CO5 Interpret hypotheses test for small samples.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	-	3	2	-	-	-	-	-	-	-
CO2	3	3	-	3	2	-	-	-	-	-	-	-
CO3	3	3	-	3	2	-	-	-	-	-	-	-
CO4	3	3	-	3	2	-	-	-	-	-	-	-
CO5	3	3	-	3	2							
Course Correlation Mapping	**3**	**3**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1 ALGEBRAIC AND TRANSCENDENTAL EQUATONS, INTERPOLATION *(09 Periods)*

Solution of algebraic and transcendental equations: Bisection method and Newton-Raphson's method. Finite differences, relation between operators, interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Lagrange's formula.

Module 2 NUMERICAL DIFFERENTIATION AND INTEGRATION *(10 Periods)*

Numerical Differentiation- Newton's forward and backward difference formulae, numerical integration- trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.

Module 3 RANDOM VARIABLE AND DISTRIBUTIONS *(09 Periods)*

Random variables (discrete and continuous), probability density functions, probability distribution: Binomial - Poisson - normal distribution and their properties (mathematical expectation and variance).

Module 4 TEST OF SIGNIFICANCE FOR LARGE SAMPLES *(09Periods)*

Formulation of null hypothesis, critical regions, level of significance. Large sample tests: Test for single proportion, difference of proportions, test for single mean and difference of means.

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Module 5   TEST OF SIGNIFICANCE FOR SMALL SAMPLES   *(08 Periods)*
Student's t-distribution (single mean, two means and paired t-test), Testing of equality of variances (F-test). Chi-square test for goodness of fit.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Write a Python program to solve algebraic equation by bisection method.
2. Write a Pseudo code on numerical integration using Simpson1/3 method.
3. What is the importance of probability distribution in computer science engineering?
4. If you draw from a normal distribution with known values of parameters, how do you generate draws in a uniform distribution?

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:
1.   B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 44/e, 2019.
2.   S.S. Sastry,*Introductory Methods of Numerical Analysis*,Prentice Hall of India, 5th Edition, 2012.
3.   Miller and Freund's, *Probability and Statistics for Engineers*, Prentice Hall of India, 8th Edition,2011.

REFERENCE BOOKS:
1.   Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 9th Edition, 2006.
2.   T.K.V.Iyenger, Krishna Gandhi and others, *Probability & Statistics*, S.Chand.
3.   S. C. Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, Sultan Chand and Sons Publications, 11th Edition, 2012.

VIDEO LECTURES:
1.   https://nptel.ac.in/courses/127106019
2.   https://nptel.ac.in/courses/111106112
3.   https://nptel.ac.in/courses/111105041
4.   https://nptel.ac.in/courses/111106112

WEB RESOURCES:
1.   https://www.pdfdrive.com/introductory-methods-of-numerical-analysis-by-ss-sastry-d148704487.html
2.   https://faculty.ksu.edu.sa/sites/default/files/probability_and_statistics_for_engineering_and_the_sciences.pdf
3.   http://brharnetc.edu.in/br/wp-content/uploads/2018/11/21.pdf
4.   http://www.mi.sanu.ac.rs/~gvm/Teze/Numerical%20methods%20In%20Computational%20Engineering.pdf

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM101407	**NUMBER THEORY AND ALGEBRA**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: The course contains various topics related to Number theory and its applications, Rings, ideals, polynomial rings and finite fields. In particular this contains the topics related to arithmetic functions and congruences which are helpful to the students in cryptography and Network security related topics in computer sciences.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate the knowledge on the conceptsof Basic number theory and their applications in computer sciences.

CO2 Apply knowledge congruences in the computer programming involved in network security issues

CO3 Evaluating and analyze the results and concepts in cryptography through the knowledge of Arithmetic functions and their properties.

CO4 Apply the techniques of abstract algebra in evaluation of the problems in network security.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	2	1	-	-	-	-	-	-	-
CO2	3	3	-	2	2	-	-	-	-	-	-	-
CO3	3	3	-	2	1	-	-	-	-	-	-	-
CO4	3	3	-	2	1	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	-	2	2	-	-	-	-	-	-	-

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1   BASIC NUMBER THEORY   (09 Periods)
Divisibility of integers, GCD and LCM of integers and their properties, Prime numbers and their properties, Euclidean algorithm.

Module 2   CONGRUENCES   (09 Periods)
Congruences and their elementary properties, Complete and reduced residue systems, Linear congruences, Chinese Remainder theorem, Fermat's theorem, Wilson's theorem, Applications.

Module 3   ARITHMETIC FUNCTIONS   (09 Periods)
Arithmetic functions, multiplicative and totally multiplicative functions, Euler's totient function, Divisor function, Sum of divisors (The function σ), Mobius function ($\mu(n)$), Elementary properties of arithmetic functions.

Module 3   Rings and Ideals   (09 Periods)
Rings, examples of Rings. Basic properties, Integral domain, Field and Ideals, Ring homomorphism and isomorphism.

Module 4   Polynomial Rings and Finite fields   (09Periods)
Polynomial ring in one variable, Irreducible polynomials over finite fields, Factorization polynomial over finite fields, properties of finite fields, Primitive roots.

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EXPERIENTIAL LEARNING

1. Exhibit the complete residue system modulo 17 composed entirely of multiples of 3.
2. Analyse the numbers and prove every square number is of the form 5k-1, 5k, 5k+1, where n is some positive integer.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Nadiya Gubareni, *Introduction to Modern Algebra and its applications*, CRC Press, 2019.

2. K.C. Chowdhury, *A first course in Number Theory*, Asian Books, First edition, 2004.

3. Hiram Paley, Paul M. Weichsel, *First course in Abstract Algebra*, Holt, Rinehart and Winston, First Edition, 1966.
4. Joseph Silverman, *A Friendly introduction to Number Theory*, Pearson Publishers, 5th Edition, 2019.
5. Edwin Weiss, *First course in Algebra and Number Theory*, Academic Press, 1971.

REFERENCE BOOKS:

1. Papantonopoulou, Algebra, *Pure and Applied Mathematics*, Prentice Hall, 2002.

2. Arkadii slinko, *Algebra fir applications*, Springer Publications, 2015.

3. Abhijit Das, *Computational Number Theory*, CRC Press, 2013.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=yHwneN6zJmU

2. https://www.youtube.com/watch?v=6DfXcNv6as4

3. https://www.youtube.com/watch?v=MNj_e-t9tIs&list=PLLtQL9wSL16htZdyMm99giCaam049Od4x
4. https://www.youtube.com/playlist?list=PLU6SqdYcYsfLyL330UDwLrRvNvWbto7DR

WEB RESOURCES:

1. https://math.libretexts.org/Courses/Mount_Royal_University/MATH_2150%3A_Higher_Arithmetic/4%3A_Greatest_Common_Divisor_least_common_multiple_and_Euclidean_Algorithm
2. https://ocw.mit.edu/courses/18-781-theory-of-numbers-spring-2012/de23a8d881a615303f6d4fa665669dc9_MIT18_781S12_lec4.pdf
3. https://crypto.stanford.edu/pbc/notes/numbertheory/mult.html
4. https://sites.math.washington.edu/~bviray/teaching/RingHomomorphismsAndIsomorphisms.pdf
5. https://www.birs.ca/workshops/2006/06w5021/report06w5021.pdf

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Course Code	Course Title	L	T	P	S	C
22MM101408	**STATISTICS FOR ENGINEERS**	3	-	-	-	3

Pre-Requisite - Numerical Methods, Probability and Statistics

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on different sample collection methods, correlation and regression, ANOVA, non parametric tests and statistical quality control and also real-time applications of all these different types' statistical techniques. This course also gives ability to implement features of ANOVA and experimental design and to perform the data analysis by using non parametric tests.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Identity different sample collection methods, probability theorems, interpretation and presentation techniques for decision making.

CO2 Analyse correlation and regression to measure the relationship between two variables.

CO3 Apply ANOVA concepts to make a confident and reliable decision.

CO4 Perform data analysis using non- parametric tests.

CO5 Apply statistical quality control to design charts for monitoring the process performance of a continuous data.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-
CO5	2	3	2	1	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	2	-	-	-	-	-	-	-	-	-

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   DESCRIPTIVE STATISTICS AND PROBABILITY   *(10 Periods)*
Descriptive Statistics: Collection of data, Classification and Tabulation of data, Diagrammatic and Graphic representation of data, Measures of Central value - Mean, Median, Mode; Measures of Dispersion- Quartile deviation, Mean deviation, Standard deviation;

Probability: Definition of probability, Addition theorem, Multiplication theorem, Bayes' theorem.

Module 2:   CORRELATION ANALYSIS & REGRESSION ANALYSIS   *(09 Periods)*
Correlation Analysis: Introduction to Correlation, Types of Correlation, Methods of Studying Correlation, Karl Pearson's Coefficient of Correlation, Rank Correlation Coefficient, Partial Correlation, Multiple Correlation.

Regression Analysis: Introduction anduses of Regression Analysis, Difference between Correlation and regression analysis, Regression lines*, Regression equations.*

Module 3   ANOVA & EXPERIMENTAL DESIGN   *(10 Periods)*
ANOVA: Introduction to ANOVA , Assumptions of ANOVA, Techniques of ANOVA, , ANOVA in

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One way and Two-Way Classification Model,
Experimental Design: Randomized Block Design, Latin Squares, Randomized Blocks Vs Latin Square.

Module 4   NON-PARAMETRIC TESTS   *(08 Periods)*
Introduction to Non-Parametric tests, Advantagesof Non-Parametric Tests, The Sign Test, A Rank Sum Test: The Mann-Whitney U-Test, The One Sample Runs Test, The Kruskal-Wallis Or H-Test.

Module 5   STATISTICAL QUALITY CONTROL   *(08 Periods)*
Introduction to SQC, Advantages and limitations of SQC, Control Charts, $\bar{X}$ Chart, R Chart, Control Chart for C, Control Chart for P.

                                                            Total Periods: 45

EXPERIENTIAL LEARNING:
1. Let's say you golfed nine holes. Each number below represents the number of swings it took you to sink the ball in the hole. If you're lucky and you have some golf skills, your score is the following:
   8, 4, 10, 4, 4, 5, 4, 5, 6
   You go back into the clubhouse and are quite pleased with your score. Your friend says that his mean score was 6, his median was 7 and his mode was 6. Did you score better than your friend?
2. A Company organizes meetings often. Find the efficiency of the meetings using correlation analysis by considering two values. Namely, time spent for the meetings and positive ideas came out of the meeting. Draw a graph to analyse the efficiency the meeting conducted in a year.
3. A large scale farm is interested in understanding which of three different fertilizers leads to the highest crop yield. They sprinkle each fertilizer on ten different fields and measure the total yield at the end of the growing season. To understand whether there is a statistically significant difference in the mean yield that results from these three fertilizers, conduct ANOVA using "type of fertilizer" as the factor and "crop yield" as the response.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOK(S):

1.   S.P. Gupta and Sultan, *Statistical Methods*, Chand & Sons Publication, 44th Edition, 2017.

REFERENCE BOOK(S):

1.   Jay L.Devore, *Probability and Statistics for Engineering and Sciences*, Cengage Learning, 2015.
2.   Ronals E.Walpole, Raymond H.Mayers, Sharon L.Myers, Keying E.Ye, *Probability and Statistics for Engineers and Scientists*, Pearson Publication, 9th Edition, 2014.
3.   Shankar Rao, *Probability and Statistics for Science and Engineering*, University Press, 2015

VIDEO LECTURES:

1.   https://archive.nptel.ac.in/courses/102/106/102106051/
2.   https://archive.nptel.ac.in/courses/110/107/110107114/
3.   https://archive.nptel.ac.in/courses/102/101/102101056/
4.   https://archive.nptel.ac.in/courses/111/104/111104120/
5.   (164) Statistics 101: ANOVA, A Visual Introduction - YouTube
6.   https://www.youtube.com/watch?v=qb3mvJ1gb9g

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WEB RESOURCES:

1. https://intranet.missouriwestern.edu/cas/wp-content/uploads/sites/17/2020/05/Measures-of-Central-Tendency-2014.pdf
2. http://www.uop.edu.pk/ocontents/Chatper%202.pdf
3. https://rcub.ac.in/econtent/ug/bcom/sem4/Business%20Statistics%20Unit%204%20Correlation%20and%20Regression.pdf
4. https://www.stats.ox.ac.uk/pub/bdr/IAUL/ModellingLecture4.pdf
5. https://web.lemoyne.edu/courseinformation/MTH%20112/RINAMAN/instman/CH14.PDF
6. http://ndl.ethernet.edu.et/bitstream/123456789/78721/2/Lecture%20Note%20Statistical%20Quality%20Control%20.pdf

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM102403	CALCULUS AND TRANSFORMATION TECHNIQUES	3	-	2	-	4

Pre-Requisite -

Anti-Requisite 22MM101403 - CALCULUS AND TRANSFORMATION TECHNIQUES

Co-Requisite -

COURSE DESCRIPTION: This course consists of topics in Calculus and Transformation Techniques with applications to various engineering problems. It covers the topics, Mean Value Theorems, Taylor's and Maclaurin's Theorems. It includes functions of two or more variables together with their applications. This course is designed to train students with the basic integral transform techniques.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Make use of mean value theorems to solve engineering problems.

CO2. Identify the maxima and minima of multivariable functions.

CO3. Determine Laplace transform of different functions arising in engineering problems.

CO4. Apply Laplace transform and its inverse to solve initial and boundary value problems.

CO5. Determine the Fourier series and Fourier transforms of various functions.

CO6. Work independently or in teams to solve problems with effective communication.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	1	1	-	-	-	-	-	-	-
CO2	3	3	-	1	1	-	-	-	-	-	-	-
CO3	3	2	-	2	1	-	-	-	-	-	-	-
CO4	3	3	-	3	1	-	-	-	-	-	-	-
CO5	3	3	-	3	1	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-
Course Correlation Mapping	3	3	-	2	1	-	-	-	3	3	-	-

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

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COURSE CONTENT

Module 1:   SINGLE VARIABLE CALCULUS   *(08 Periods)*

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof) related problems.

Module 2:   MULTIVARIABLE CALCULUS   *(07 Periods)*

Introduction to function of several variables, Jacobian and its properties, Functional dependence, Maxima and minima of functions with two variables, Lagrange's multiplier method.

Module 3   LAPLACE TRANSFORMS   *(10 Periods)*

Definition of Laplace transform, Existence conditions, Laplace transforms of standard functions, Linearity property, First and second shifting theorems, Change of scale property, Laplace transforms of derivatives and integrals, Multiplication by t^n, Division by t, Laplace transform of periodic functions (without proofs), Laplace transforms of unit step function and unit impulse function.

Module 4   INVERSE LAPLACE TRANSFORMS   *(10 Periods)*

Definition of inverse Laplace transform, Linearity property, First and second shifting theorems, Change of scale property, Inverse Laplace transforms of derivatives and integrals, Multiplication by s, Division by s, Convolution theorem (without proofs), Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients.

Module 5   FOURIER SERIES AND FOURIER TRANSFORMS   *(10 Periods)*

Fourier series: Determination of Fourier coefficients, Euler's formulae, Convergence of Fourier series (Dirichlet's conditions), Fourier series in $(-\pi, \pi)$, Half range sine and cosine expansions, Parseval's identity in $(0, \pi)$.

Fourier Transforms: Complex Fourier transform, Fourier sine and cosine transforms, Inverse Fourier transforms.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Obtain the Taylor series of any Single variable function (Algebraic or Transcendental) and then plot the graph of the function given using MATLAB.
2. Verify Rolle's theorem for any function f(x) in the interval [a,b] using MATLAB.
3. Write a MATLAB program to verify Lagranges mean value theorem for any function f(x) in [a,b].
4. Obtain the Taylor series of any multi variable function and then plot the graph of the function given using MATLAB.
5. Write a MATLAB program to estimate the maxima and minima of a two variable function.
6. Estimate the maxima and minima of a multivariable function using Lagrange multiplier method through MATLAB.
7. Write MATLAB codes to find Partial derivative of a given function f(x,y) at a given point (x_1,y_1) and also visualize it.
8. Solve and visualize solutions of the first order differential equations using Laplace transform through MATLAB code.
9. Solve and visualize solutions of the second order differential equations using Laplace transform through MATLAB code.
10. Find the constant, first sine and cosine terms in the Fourier series expansion of the function y=f(x) from the given data through MATLAB.

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RESOURCES

TEXT BOOKS:

1. B. S. Grewal, *Higher Engineering Mathematics*, Khanna publishers, 44th edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th edition, 2011.

REFERENCE BOOKS:

1. B. V. Ramana, *Higher Engineering Mathematics*, Tata McGraw hill, 1st edition, 2017.
2. N.P. Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/111105121
2. https://nptel.ac.in/111106139/
3. https://nptel.ac.in/courses/111106111/

WEB RESOURCES:

1. http://www.efunda.com/math/math_home/math.cfm
2. http://www.sosmath.com/
3. http://www.mathworld.wolfram.com/

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22AI105002	**DISRUPTIVE TECHNOLOGIES**	-	1	2	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Google AI tools for speech recognition, language detection and Python API to build Machine Learning Models. This course also focuses on demonstration of Cloud Services and tools, Internet of Things with Arduino and simulation of robots using robotics development platform.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Use Google AI tools for speech recognition and language detection.

CO2. Construct Machine Learning Modelsusing Python API to solve Classification problems.

CO3. Use Cloud Services and tools for effective collaboration and data sharing

CO4. Design an interface to embedded systems using real time sensors with Arduino.

CO5. Design and simulate robot using robotic simulation platforms for societal applications.

CO6. Work independently and communicate effectively in oral and written forms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3	3	2	-	-	-	-	-	-	-	3	-	-
CO2	2	3	3	3	3	2	-	-	-	-	-	-	-	3	-	-
CO3	2	-	-	-	3		-	-	-	-	-	-	-	3	-	-
CO4	2	-	3	-	2	2	2	-	-	-	-	-	-	3	-	-
CO5	2	-	3	-	-	2	-	-	-	-	-	-	-	3	-	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	3	-	-
Course Correlation Mapping	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**-**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**

Correlation Levels: **3: High;**   **2: Medium; 1: Low**

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

Artificial Intelligence – Introduction, Applications, Trends, Technologies, Relevant Libraries/API; Machine Learning – Introduction, Applications, Python Libraries/API.

1. Speech Recognition: Read an audio file with Python and use the Google Speech Recognition API to perform conversion of Speech to Text.

2. Language Detection: Detect the language of the text using Language Detection Library (langdetect) ported from Google's languagedetection.

3. Object Detection: Detect multiple objects present in an image using Detection- Facebook's API.

4. Build a classification model using Decision Tree learning algorithm. Use Iris dataset and scikit-learn python library to build the model.

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Cloud Computing – Introduction, Applications, Services - PaaS, IaaS, SaaS, Virtualization, Application Deployment.

1. Create Windows virtual machine using VMware workstation under IaaS.
2. Create online survey forms, questionnaires and analyse the result of survey using Zoho under SaaS.
3. Develop a web application and deploy the same on Amazon Simple Storage Service.

Internet of Things - Introduction, Applications, Arduino IDE, Servo Motor, Sensors, ECG System.

1. Design and simulate Servo motor interfacing with Arduino.
2. Design and simulate Flame Sensor interfacing with Arduino.
3. Design and implement an IoT ECG (Electrocardiogram) System to recordhearts electrical activity.

Robotics - Introduction, Applications, understanding robotics development platform to model, Program and Simulate robots.

1. Design a Two Wheel line following robot integrated with infrared sensors.
2. Design a collision avoidance robot in multi obstacle based environment.

RESOURCES

REFERENCES:

1. Sebastian Raschka, Vahid Mirjalili, Python Machine Learning, Packt Publishing, 3rd Edition, 2019.
2. Simon Monk, Programming Arduino, Second Edition, McGraw-Hill Education,2016.

SOFTWARE/TOOLS:

1. Python – Google SpeechRecognition API,Google langdetect API, Scikit-learn
2. Virtual Box and Virtual PC Software
3. Arduino Kit, Python/C
4. CoppeliaSim

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=lKra6E_tp5U
2. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
3. https://www.youtube.com/watch?v=H_ustCy4Ks8
4. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
5. https://www.youtube.com/watch?v=xq_JKhbYWKk
6. https://www.youtube.com/watch?v=uBLcAz7obwA

WEB RESOURCES:

1. https://gsuite.google.com/learning-center/products/#!/
2. https://pypi.org/project/langdetect/
3. https://cloud.google.com/translate/docs
4. https://scikit-learn.org/stable/modules/generated/sklearn.tree.DecisionTreeClassifier.html
5. Understanding Amazon Web Services, https://aws.amazon.com/

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22AI105003	**FREE AND OPEN SOURCE SOFTWARE**	-	1	2	-	2
Pre-Requisite	Programming for Problem Solving					
Anti-Requisite	-					
Co-Requisite	Object Oriented Programming through Java					

COURSE DESCRIPTION: This course covers the basic programming constructs of Go language. It emphasizes the concepts including string handling and implementation of HTTP protocols in Go language. The course also provides hands on training on application development using MIT app inventor and GIT commands related to repositories.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Create source code repositories using GitHub.
CO2. Create communication between client to server and develop interactive software applications using GO language.
CO3. Develop basic mobile applications using MIT App inventor.
CO4. Work independently and communicate effectively in oral and written Forms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3	3	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	3	3	-	3	-	-	-	-	-	-	-	3	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	3	-	3	-	3	-	-	-	-	-	-	-	3	-
Course Correlation Mapping	**3**	**2**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	-

Correlation Levels: **3: High;**   **2: Medium;1: Low**

EXPERIENTIAL LEARNING

List of Experiments:
GIT HUB

Theory Topics: Git Basics, Git repositories, local repositories, remote repositories, Secure shell encryption algorithm.
1. Configuration of Git using gitconfig, gitlog and gitaliases commands.
2. Initializing the local repositories using Git commands: add, commit and status.
3. Moving the local repository to the Git hub using the commands remote, push and pull.
4. Creation of remote access to Github using SSH key.
5. I/O management system with Github using branch and merge techniques.

Go Programming Language
Theory Topics: Variables, Data types, Conditional statements, Looping statements, strings.
1. Peano numbers are a simple way of representing the natural numbers using only a zero value and a successor function. Ex. 0->1->2->3->5…. Write a GO program to generate Peano integers.
2. Write a GO program to check if two trees are equivalent if they both have the same topology and if the objects contained in corresponding nodes are equal.
3. Hypertext Transfer Protocol (HTTP) is an application-layer protocol for transmitting hypermedia documents. It was designed for communication between web client and web servers. Write a program to configure HTTP server for establishing a simple client – server communication.

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4. Code the solutions to a few string-related hacker rank problems.
   Ex: Prints the text of each line that appears more than once in the standard input, preceded by its count.

Build Apps with MIT App Inventor

Theory Topics: Frames, Blocks, embedding audio & video

1. Develop the   Hello Codi App by using MIT App Inventor with the components: Blocks Editor, audio, video, clock timer.
2. Develop a Digital Doodle Application using MIT App Inventor.

RESOURCES
REFERENCES
GIT Hub

1. Scott chacon, Ben Straub, *Pro Git*, Second Edition, APress open, 2014.

Go Programming Language

1. Alan A. A. Donovan, Brain W. Kernighan, *The Go Programming Language,*First Edition, Addison-Wesley, New York, 2005.
2. https://gophercises.com/.

MIT App Inventor

   1. http://appinventor.mit.edu/

SOFTWARES/TOOLS used:

1. System Software: Git hub, Go Compiler & MIT App Inventer.

 VIDEO LECTURES:

1. https://onlinecourses.swayam2.ac.in/aic20_sp37/preview
2. https://www.coursera.org/courses?query=github
3. https://www.youtube.com/c/Freecodecamp
4. https://www.simplilearn.com/tutorials/git-tutorial/git-tutorial-for-beginner

 WEB RESOURCES:

1. https://docs.github.com/en
2. https://go.dev/doc/tutorial/getting-started
3. https://appinventor.mit.edu/explore/ai2/tutorials

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CB105001	**COMPUTER HARDWARE AND SYSTEM ESSENTIALS**	-	1	2	-	2

Pre-Requisite   –
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on internal components of a computer, assemble a computer system, install an operating system, and troubleshoot using system tools and diagnostic software. Students will also be able to understand various network cables, connectors and TCP/IP networks, and work group.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Identify different hardware components on personal computer and peripheral devices.
CO2. Create network architecture using TCP and UDP protocols for data transmission.
CO3. Devise the solutions for the problems occurred in personal computer in Operating Systems.
CO4. Implement the functionalities of different peripheral devices and networks by configuring multi-functional devices.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	1	1	-	-	-	-	-	-	-	-	-	-	3
CO2	3	-	3		1	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	3	1	2	-	-	-	-	-	-	-	-	-	-	3
CO4	3	2	3	1		-	-	-	-	-	-	-	-	-	-	3
Course Correlation Mapping	3	3	3	1	1	-	-	-	-	-	-	-	-	-	-	3

Correlation Levels: **3: High;**   **2: Medium; 1: Low**

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

HARDWARE CONFIGURATION

Peripherals of the computer

1.   Implement the following activities:
a) Configure settings using BIOS/UEFI tools on a PC.
b) Identify different components of mother board
c) Analyze various RAM types, PC extensions cards and storage devices

2.   Implement the following activities:
a) Identify various CPU's, cooling methods and PC connection interfaces
b) Identification of various power supply, display devices and common PC Connectors
c) Install and configure common peripheral devices and SOHO multi-function device

PC Networking using Packet Tracer

Network Types and Components, Topologies, Wired and Wireless Transmission, Protocols.

1.   a) Identify various types of network cables and connectors and characteristics
b) Implement the following characteristics of TCP/IP

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i)IPv4 and IPv6 ii)Client side DNS Settings

2. a) Identify following TCP and UDP Ports
   i)21-FTP   ii)443-HTTPS   iii)80-HTTP   iv)Telnet
   b) Analyze the following TCP and UDP protocols
   i)SMD   ii)SNMP   iii)DHCP

3. a) Configure the following network types
   i) LAN   ii) WAN   iii) WLAN
   b) Configure network architecture using the following
   i) HUB   ii) Switch   iii) Router

OPERATING SYSTEMS

Introduction to Operating System, Characteristics of Operating System, Types of Operating System and its components

1. Installation of Windows Operating System

2. Installation of Application and Device Drivers management

TROUBLESHOOTING

Introduction to trouble shooting, Hardware and Software Trouble shooting

1. a) Study the common problems related to the following
   i) Mother Board   ii) RAM   iii) CPU   iV) Power
   b) Troubleshoot the following failures
   i) Read/Write Failure   ii) Slow Performance   iii) Failure to boot

2. Trouble Shoot the following symptoms of Video, projector and display issues
   i) VGA Mode   ii) No Image of Screen   iii) Dead Pixels   iv) Color patterns

3. Trouble shoot the following issues of wired, wireless and mobile devices
   i) No Connectivity   ii) IP conflict   iii) Ghost Cursor iv) Stiking Keys

RESOURCES

REFERENCES:

1. David Anfinson, Allan Johnson and Kathleen Czurda, *IT Essentials v7 Companion Guide*, CISCO Press, 2020
2. Brian W. Kernighan, *Understanding the Digital World: What You Need to Know about Computers, the Internet, Privacy, and Security*, Second Edition, Princeton University Press, 2021
3. Kavin Wilson, *Exploring Computer Systems: The Illustrated Guide to Understanding Computer Systems, Hardware &Networks*, Elluminent Press, 2019

SOFTWARE/TOOLS:

1. Windows 8/10 operating systems
2. Cisco Packet Tracer

VIDEO LECTURES:
1. https://www.edx.org/course/computer-hardware-and-operating-systems
2. https://www.coursera.org/learn/computer-hardware-software

WEB RESOURCES:
1. https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/configuration/15-s/ir-15-s-book.pdf
2. https://www.certexams.com/comptia/a+/cert-notes-aplus-networking.htm
3. https://www.rcboe.org/cms/lib/GA01903614/Centricity/Domain/4399/Network%20n10-007.pdf
4. https://www.tutorialsweb.com/CertNotes/CompTIA-cert/A+/aplus-prac-10.htm

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22AI104001	**OBJECT ORIENTED PROGRAMMING THROUGH C++**	**3**	**-**	**2**	**4**	**5**

Pre-Requisite	Programming for Problem solving
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: This course provides a detailed discussion on basic characteristics of Object Oriented Programming through C++. It covers basic Object Oriented Programming paradigms like Classes and Objects in custom application development. The OOP concepts types of overloading and inheritance are also covered. It provides hands-on experience inimplementation of OOP features and other programming concepts like handling pointers, file and exceptions.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the concepts of Object oriented programming.

CO2. Apply function and operator overloading techniques for code optimization.

CO3. Apply inheritance and virtual functions to implement dynamic binding.

CO4. Develop robust applications using exception handling mechanism and file I/O.

CO5. Develop reliable applications to solve real world problems using Object oriented programming constructs.

CO6. Work independently or in team to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	2	3	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	2	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	3	3	2	-	1	-	-	-	-	-	-	-	3	-
CO5	3	2	3	3	2	-	1	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	3	-
Course Correlation Mapping	**3**	**2**	**2.6**	**2.6**	**2**	**-**	**1**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**-**

Correlation Levels: **3: High;**   **2: Medium;1: Low**

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COURSE CONTENT

Module 1:   C++ FUNDAMENTALS   *(10 Periods)*

Need of Object-Oriented Programming - Comparison of procedural programming and Object-Oriented Programming - Characteristics of Object-Oriented Languages - C++ Programming Basics: Basic Program Construction - Data Types, Variables, Constants - Type Conversion, Operators, Library Functions - Loops and Decisions, Structures - Functions : Simple Functions, Passing arguments, Returning values, Reference Arguments. - Recursion, Inline Functions, Default Arguments - Storage Classes - Arrays, Strings.

Module 2:   OOP FUNDAMENTALS   *(09 Periods)*

Classes and Objects: Classes, Friend functions, Friend classes, Inline functions, Parameterized constructors, Static Class Members, The Scope resolution operator, nested and local classes, Passing Objects to functions, returning objects, object assignment. Arrays, Pointers, References: Array of Objects, Pointers to objects, the This pointer.

Module 3   FUNCTION AND OPERATOR OVERLOADING   *(09 Periods)*

Function Overloading: Copy Constructors, and Default Arguments: Function Overloading, Overloading Constructors, Copy constructors, Default Function Arguments.

Operator Overloading: Creating a member operator function, operator overloading using a friend function, overloading new and delete, overloading some special operators, and comma operator.

Module 4   INHERITANCE AND VIRTUAL FUNCTIONS   *(09 Periods)*

Inheritance: Base Class Access Control, Inheritance and protected members, inheriting multiple base classes, constructors, destructors, and inheritance, granting access, virtual base classes.

Virtual Functions: Pointers to objects, Pointers to derived classes, Virtual Functions, Pure Virtual Functions.

Module 5   FILE I/O AND EXCEPTIONS   *(08 Periods)*

Files: File Pointers - Error handling in File I/O - File I/O with member Functions - Overloading the extraction and Insertion Operators - Multi File Programs

Exceptions: Need of Exceptions, keywords, Simple and Multiple Exceptions - Re-throwing Exception and Exception Specifications, Custom Exception

Total Periods: 45

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EXPERIENTIAL LEARNING

LIST OF EXERCISES:

OOPS & C++ Fundamentals

1. a. Write a C++ program to identify appropriate data types and variables to find the size of various datatypes. Display the variables along with their size.

    b. Write a C++ program to take name, address as character array, age as int, salary as float and contains inline functions to set the values and display it.

2. a. Write a C++ program to display names, roll no and grades of 3 students whohave appeared in examination. Declare the class of name, roll no and grade. Create an array of class objects, read and display the contents of array.

    b. Create a class TIME with members hours, minutes, seconds. Take input, add two time objects passing objects to function and display the resultant time in hours, minutes &seconds.

3. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.Write a C++ program to read the data of N employee and compute Net salary of eachemployee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).

POLYMORPHISM

4. a. Create a base class basic_info with data members name ,roll no, sex and two member functions getdata and display. Derive a class physical_fit from basic_info which has data members height and weight and member functions getdata and display. Display all the information using object of derived class.

    b. Consider two complex number in the form a+bi and c+dj, Write a program overload binary + operator to perform addition of the complex numbers.

INHERITANCE

5   a. Write a C++ Program to calculate the area and perimeter of rectangles using concept of Hierarchical inheritance. Area class is derived from base class Rectangle. Perimeter class is also derived from base class Rectangle.

    b. Write a C++ program to create Employee and Student inheriting from Person using Hierarchical Inheritance. The Person class should contain the common attributes of Employee and Student class.

6. Design three classes STUDENT, EXAM and RESULT. The STUDENT class has data members such as rollno, name. Create a class EXAM by inheriting the STUDENT class. The EXAM class adds data members representing the marks scored in six subjects. Derive the RESULT from the EXAM class and has its own data members such as total marks. Write a C++ program to model this relationship.

7. Create a base class called SHAPE. Use this class to store two double type values. Derive two specific classes called TRIANGLE and RECTANGLE from the base class. Add to the base class, a member function getdata() to initialize base class data members and another member function display to compute and display the area of figures. Make display a virtual function and redefine this function in the derived classes to suit their requirements. Using these three classes design a program that will accept driven of a TRIANGLE or RECTANGLE interactively and display the area.

FILE I/O

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8. a. Write a C++ program named store_temps.cpp that creates a file named raw_temps.txt with temperature data. Fill thefile with at least 50 temperature readings.

    b. Assuming that a text file named FIRST.TXT contains some text written into it, write a function named copyupper() in C++, that reads the file FIRST.TXT and creates a new file named SECOND.TXT contains all words from the file FIRST.TXT in uppercase.

9. Write a C++ program that accepts two file names and produces a new file that is thecontents of the first file followed by the contents of the second; that is, the programconcatenates the two files.

EXCEPTION HANDLING

10. Add an exception handler (try/catch/throw) to the class that throws an error message (e.g. "value out of range") in the getValue function that is caught and handled in the main program. Implement two version of the program. In version1, throw the error in getValue, catch the error in the main, display an error message in the main, and then allow the program to terminate. In the second version, perform the same basic actions (throw and catch) but keep re-invoking the getValue function from the main program until the user enters a valid value.

PROJECT BASED LEARNING:

Faculty shall provide Projects relevant to the contents of the course.

Sample Projects:

1. **Bookshop inventory system**
    The project is to build the bookshop inventory system in C++ that helps to keep track of all the book records in a shop. Below are the features to be implemented:
    *   Add new book and the details of the book are:
        o Book ID
        o Name of book
        o Name of Author
        o Number of books
    *   Delete a book
    *   Update anexistingbook detail
    *   Display summary of all the books
    *   Search a book

2. **Online Examination Management System**
    The project is to build the online examination management system in C++ that helps to conduct online proctored examinations. Below are the features to be implemented:
    *   Add New Students
    *   Student Login
        o Registration for examination
        o Attempting the questions
    *   Faculty Login
        o Uploading the questions
    *   Proctor Login
        o Online monitoring of students
    *   Admin View
        o Consolidation of marks
        o Release of results

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RESOURCES

TEXT BOOKS:

1. Herbert Schildt,"C++ - The Complete Reference", 4th edition, Tata McGraw Hill, 2018.

2. E.Balaguruswamy "Object Oriented Programming with C++", 6th edition, Tata McGraw Hill Education, 2015.

REFERENCE BOOKS:

1. Cohoon and Davidson, "C++ Program Design: An introduction to Programming and object – Oriented Design", 3rd Edition, Tata McGraw Hill, 2003.

2. Robert Lafore, "Object-Oriented Programmig in C++", 4th edition, Pearson Education, 2008.

3. Walter Savitch,**"**Problem Solving with C++", 9th edition, Pearson Education, 2015.

SOFTWARE/TOOLS:

1. Software: Dev C++

VIDEO LECTURES:

1. https://www.coursera.org/learn/c-plus-plus-a#syllabus

2. https://www.udemy.com/free-learn-c-tutorial-beginners/

3. https://onlinecourses.nptel.ac.in/noc21_cs02/preview

WEB RESOURCES:

1. http://www.cplusplus.com/files/tutorial.pdf

2. http://mazonka.com/shared/Straustrup4th.pdf

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22AI104002	**OBJECT ORIENTED PROGRAMMING THROUGH JAVA**	3	-	2	4	5

Pre-Requisite	Programming for Problem Solving
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: This course is emphasize on the fundamentals structure design with classes including development, testing, implementation and documentation. This course also focuses on understanding and practical mastery of object oriented concepts such as classes, objects, data abstraction, methods, method overloading, inheritance and polymorphism. By end of the course, students will acquire the basic knowledge and skills necessary to implement object-oriented programming techniques in software development using Java.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Apply object oriented programming constructs to solve computational problems.
CO2. Use Exception handling and multithreading mechanisms to create efficient software applications.
CO3. Create Web based applications using collections frameworks to solve real world problems.
CO4. Design and develop GUI using applets and swings for internet and system based applications.
CO5. Work independently or in team to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	3	3	-	-	-	2	-	-	-	-	2	3	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO4	2	3	3	-	-	-	-	2	-	-	-	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Course Correlation Mapping	1	3	2	3	1	-	1	2	3	3	2	1	3	-	-	

Correlation Levels: 3: High;   2: Medium;1: Low

COURSE CONTENT

Module 1:   OOPS FUNDAMENTALS *(09Periods)*

Introduction: History of Java, Byte code, JVM, Java buzzwords, OOP principles, Data types, Variables, Scope and life time of variables, Operators, Control statements, Type conversion and casting, Arrays.

Concepts Of Classes And Objects: Introducing methods, Method overloading, Constructors, Constructor overloading, Usage of static with data and method, Access control, this key word, Garbage collection, String class, StringTokenizer.

Module 2:   INHERITANCE, INTERFACE AND PACKAGES *(09Periods)*

Inheritance basics, Types of inheritance, Member access rules, Usage of super key word, Method overriding, Usage of final, Abstract classes, Interfaces - differences between abstract classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces; Packages - defining, creating and

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accessing a package, importing packages, access control in packages.

Module 3   EXCEPTION HANDLING AND MULTITHREADING   *(10 Periods)*

Exception Handling: Concepts of exception handling, Types of exceptions, Usage of try, catch, throw, throws and finally keywords, Built-in exceptions, Creating user defined exception;

Multithreading: Concepts of multithreading, Differences between process and thread, Thread life cycle, Creating multiple threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter thread communication.

Module 4   COLLECTION FRAMEWORK   *(08 Periods)*

Collection Framework: Collections Overview, Collection Interfaces - List, Set, Map, List - ArrayList, Linked List, Vector, Set - HashSet, TreeSet, Map - HashTable, HashMap, Accessing a collection via an Iterator, comparator, comparable.

Module 5   GUI PROGRAMMING   *(09 Periods)*

GUI Programming With Applets: Applets - Applet Class, Applet skeleton, Simple Applet; Delegation event model - Events, Event sources, Event Listeners, Event classes, handling mouse and keyboard events.

*Exploring Swing Controls:*JLabel and Image Icon, JText Field, JButton, JCheckBox, JRadioButton, JTabbed Pane, JList, JCombo Box.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

OOPS Fundamentals

1. a) Develop a Java application for generating Electricity bill.
        Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff. If the type of the EB connection is domestic, calculate the amount to be paid as follows:
        ➢ First 100 units - Rs. 1 per unit
        ➢ 101-200 units - Rs. 2.50 per unit
        ➢ 201 -500 units - Rs. 4 per unit
        ➢ >501 units - Rs. 6 per unit
        If the type of the EB connection is commercial, calculate the amount to be paid as follows:
        ➢ First 100 units - Rs. 2 per unit
        ➢ 101-200 units - Rs. 4.50 per unit
        ➢ 201 -500 units - Rs. 6 per unit
        ➢ > 501 units - Rs. 7 per unit
    b) Design a class to represent a Student details include the Student ID, Name of the Student, Branch, year, location and college. Assign initial values using Constructor. Calculate average of marks of 6 subjects and calculate attendance percentage.

2. a) Create a class Student which has data members as name, branch, roll no, age, sex, marks in five subjects. Display the name of the student and his percentage who has more than 70%.Use array of objects.
    b) Write a program to perform addition of two complex numbers using

constructor overloading. The first constructor which takes no argument is used to create objects which are not initialized, second which takes one argument is used to initialize real and imaginary parts to equal values and third which takes two argument is used to initialized real and imaginary to two different values.

Inheritance

3 a) Create a base class basic_info with data members name, roll no, sex and two member functions getdata and display. Derive a class physical_fit from basic_info which has data members height and weight and member functions getdata and display. Display all the information using object of derived class.

   b) Create class first with data members book no, book name and member function getdata and putdata. Create a class second with data members author name, publisher and members getdata and showdata. Derive a class third from first and second with data member no of pages and year of publication. Display all these information using array of objects of third class.

4 A High School application has two classes: The Person superclass (Name, age, Gender) and the Student subclass (RegNo, Dept, CGPA).Using inheritance, create two new classes, Teacher and College Student. Teacher will be like Person but will have additional properties such as salary (the amount the teacher earns) and subject (e.g., "Computer Science", "Chemistry", "English", "Other"). The College Student class will extend the Student class by adding a year (current level in college) and major (e.g., "Electrical Engineering", "Communications", "Undeclared"). Create objects and test the functionality of all the methods.

5 Develop a java application for generating pay slip on different category of employees using the concept of inheritance.

Exception Handling and Multithreading

6 Consider two integers x and y as inputand compute the value of x/y.
   Implement a class which raise an exception if x and y are not signed integers or if y is zero.

7 a) Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number

   b) Write a program that creates three threads. First thread displays "Good Morning" every one second, the second thread displays "Hello" every two seconds and the third thread displays "Welcome" every three seconds.

Collection Framework

8 Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.

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GUI Programming

9   a)   Write a java program that simulates a traffic light. The program lets the user select one of three lights: Red, Yellow or Green with radio buttons. On selecting a button an appropriate message with "STOP" or "READY" or "GO" should appear above the buttons in selected color. Initially, there is no message shown.

     b) Write an Applet that computes the payment of a loan on the amount of the loan, the interest rate and the number of months. It takes one parameter from the browser. Monthly; if true, the interest rate is per month, otherwise the interest rate is annual.

   c)   Write a java programs to find factorial of a number. User is allowed to enter a number into the text field whose factorial is to be determined. On pressing the button the value of the text field is firstly converted into integer and then processed to find its factorial. The result will get displayed in another text field. (Hint: use swings).

PROJECT BASED LEARNING:

Faculty shall provide Projects relevant to the contents of the course.
Sample Projects:
1. CALENDER APPLICATION
    Develop a calendar application that uses many windows properties to make it colorful, for example, to indicate the vacation, it uses the red foreground color. The calendar can be used for two purposes. First to see the date and month as usual calendars and second to find out the day corresponding to given date. Some of the salient features of the project are
- It uses various windows properties to make the program colorful although it has lack of graphics.
- It entirely uses java code which is written in simple manner with lots of comments and important notes can be added.
- The date with such notes appears different than others with red background color
- The months can be navigated using arrow keys.

2. TICKET RESERVATION SYSTEM
    Develop Ticket reservation system to manage details of seats, passenger, trains, Bookings and stations. The features required to be implemented are as follows
- Provides searching facility based on factors such as seats, trains, booking and stations
- Manage the information of passengers
- Shows the information of the seats and trains
- Provide filter on train, booking, time and station
- Information Management of booking
- Export excel report for trains, passengers and station
- Export pdf for booking details

RESOURCES

TEXT BOOKS:

1. Herbert Schildt, "Java the complete reference", 11th edition, McGraw Hill, Education,2018.
2. C. Thomas Wu, "An Introduction to Object-Oriented Programming with Java 5th edition", McGraw-Hill Higher Education 2010.

REFERENCE BOOKS:

1. J. Nino and F.A. Hosch,"An Introduction to programming and OOPS design using Java", 3rd edition, John Wiley & sons, 2008.
2. P. Radha Krishna,"Object Oriented Programming through Java", 1st edition, Universities Press, 2007.

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SOFTWARE/TOOLS:

1.   Software: Eclipse / Net beans / JDK 1.7
2.   Java compatible web browser

VIDEO LECTURES:

1.   https://nptel.ac.in/courses/106105191
2.   https://www.udemy.com/course/java-tutorial/

WEB RESOURCES:

1.   https://www.tutorialspoint.com/java/java_tutorial.pdf
2.   https://www.guru99.com/java-tutorial.html

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CM101401	PRINCIPLES OF BUSINESS ECONOMICS AND ACCOUNTANCY	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION:
Business economics and demand analysis; theory of production and cost analysis; markets and pricing; principles of accounting and capital; final accounts and tally ERP9.0.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Demonstrate the principles of Business Economics and theories of Demand.
CO2. Apply the theories of Production and Cost to the managerial decision-making of an organization.
CO3. Determine the Price and Output relation in the different Market structures.
CO4. Demonstrate the principles of Accountancy and sources of Capital
CO5. Analyze the profitability and soundness of an organization.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	1	-	3	-	2
CO2	3	2	-	-	-	-	-	1	-	3	-	2
CO3	3	2	-	-	-	-	-	1	-	3	-	2
CO4	3	2	1	-	-	-	-	1	-	3	-	2
CO5	3	2	1	-	-	-	-	1	-	3	-	2
Course Correlation Mapping	3	2	1	-	-	-	-	1	-	3	-	2

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: BUSINESS ECONOMICS AND DEMAND ANALYSIS *(09 Periods)*

Definition - Nature and Scope of Business Economics - Demand: Determinants of demand –Demand function - Law of demand, assumptions, and exceptions - Elasticity of demand –Types of elasticity of demand-Demand forecasting and methods of demand forecasting.

Module 2 THEORY OF PRODUCTION AND COST ANALYSIS (09 *Periods*)
Production Function: Input-output relationship-Law of Variable proportion-Isoquants and Isocosts
Cost Concepts: Total, Average and Marginal Cost **-** Fixed vs. Variable costs – Opportunity Costs Vs Outlay Costs– Separable Costs Vs Joint Costs, Urgent Costs Vs Postponable Costs-Avoidable Costs Vs Unavoidable Costs
Break Even Analysis (BEA)–Assumptions, Merits and demerits- Determination of Break-Even Point (Simple problems).

Module 3: MARKETS AND PRICING *(09 Periods)*
Market Structure: Types of Markets - Features of perfect competition - Monopoly and monopolistic competition - Price and Output determination in perfect competition, monopoly and monopolistic

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Markets.

Pricing: Objectives and policies of pricing – Sealed bid pricing - Marginal cost pricing – Cost plus pricing - Going rate pricing – penetration Pricing – skimming Pricing - Block pricing –Peakl oad pricing – Cross subsidization.

Module 4 :   PRINCIPLES O FACCOUNTING & CAPITAL   *(09 Periods)*

Accountancy: Introduction – Concepts – Conventions – Double Entry Book Keeping– Journal – Ledger - Trial Balance (Simple problems)
Capital: Significance- Types of capital – Sources of Capital.

Module 5:   FINAL ACCOUNTS & TALLY ERP9.0   *(09 Periods)*
Introduction to Final Accounts – Trading account - Profit and Loss account and Balance Sheet with simple adjustments (Simple problems)
Tally ERP 9.0: Introduction – Create a company – Create ledger – Posting vouchers –Advantages of Tally.

TotalPeriods:45

EXPERIENTIALLEARNING

1. Prepare the Journal Entries by the students with practical examples.
2. Conduct an event about the market structure.
3. Do the problems on Financial Statements with practical examples.
4. Prepare are port regarding the demand and supply of electric vehicles in the Indian market.
5. From the following balances of Mr. Aravind as at 31.12.2016, prepare Trading, Profit and Loss Account for the year ended and Balance Sheet as at that date after making the necessary adjustments.

Debit Balances	Amount(Rs.)	Credit Balances	Amount(Rs.)
Drawing Account	6,000	Capital	80,000
Plant and Machinery	25,000	Sundry Creditors	10,000
Stock(opening)	15,000	Sales	1,20,000
Purchases	82,000	Returns outwards	1,000
Return Inwards	2,000	R.B.D.D.	400
Sundry Debtors	20,600	Discounts	800
Furniture & Fixtures	5,000	Rent of Premises sublet	1,200
Freight and Duty	2,000	Reserve Fund	5,000
Carriage outwards	500		
Rent, Rates & Taxes	4,600		
Printing & Stationery	800		
Trade Expenses	400		
Postage and Telegrams	800		
Insurance charges	700		
Salaries and Wages	21,300		
Cash in Hand	6,200		
Cash at Bank	25,500		
	2,18,400		2,18,400

Adjustments:
- Stock on 31.12.2006 was Rs.14,600.
- Write off Rs.600 as bad debts and provide 5% for R.B.D.D.
- Provide for depreciation on furniture 5% & Plant & Machinery at 20%.
- Insurance prepaid was Rs.100.
- Outstanding salaries Rs.700
- A fire occurred on 25th December 2006 and stock worth Rs.5,000 was destroyed and the insurance company admitted a claim for Rs.4500 only.

RESOURCES:

TEXT BOOKS:
1. H L Ahuja, *Business Economics*, S Chand Publishing, Thirteenth Edition, 2016.
2. S. P. Jainand, K.L. Narang, *Financial Accounting*, Kalyani Publishers, Twelfth Edition, 2018.

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REFERENCE BOOKS:
1. Joseph G. Nellis and David Parker, *Principles of Business Economics*, Pearson Education Canada, Second Edition, 2016.
2. Larry M. Walther, *Financial Accounting*, Create Space Independent Publishing Platform, 2017.

VIDEO LECTURES:
1. https://www.youtube.com/watch?v=xWKfKCnQqAE
2. https://www.youtube.com/watch?v=daYPYHbJ6Xc

WEB RESOURCES:
1. https://leverageedu.com/blog/scope-of-business-economics/
2. https://www.economicsdiscussion.net/break-even-analysis/break-even-point-of-a-firm-meaning-determination-and-types/21785

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MG101401	**ESSENTIALS OF LEADERSHIP**	2	-	-	-	2

Pre-Requisite

Anti-Requisite

Co-Requisite   -

COURSE DESCRIPTION: This course is designed for learners who desire to improve their leadership, communications, and workplace skills.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1.   Differentiate between leadership and management
CO2.   Identify the values common among great leaders.
CO3.   Discuss the power of positive expectations and how to apply it as a leader
CO4.   Assess what, how, and to whom you should delegate.
CO5.   Describe what it means to be an ethical leader.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	1	-	-	-	1	-	-	-	-	-	-
CO2	1	1	2	1	-	1	-	-	-	-	-	-
CO3	2	-	2	-	1	-	-	-	-	2	-	-
CO4	1	2	-	1	-	-	-	-	-	2	-	-
CO5	1	2	1	-	-	-	-	-	-	2	2	-
Course Correlation Mapping	**2**	**2**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**2**	**2**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION   *(06 Periods)*
What is leadership, leadership vs management, leadership and change, Maxwell's 5 levels of leadership, how to move to the next level

Module 2:   LEADERSHIP VALUES & EXPECTATIONS   *(06 Periods)*
14 Leadership Values, what matters most exercise. Expectations, The Pygmalion Effect, impact of positive expectations, setting expectations

Module 3:   DELEGATION   *(06 Periods)*
Definition, why delegate, delegate/empower, why people don't delegate, steps for delegation - the IDEALS model..

Module 4:   ETHICS   *(06 Periods)*
Definitions, introduction to ethics, ethics vs morals, self-assessment, Good People, Bad Choices examples, how to be an ethical leader, 8 Ethical Actions for Leaders.

Module 5:   COMMITMENT   *(06 Periods)*
Introduction, significance of commitment, Universal Laws of Leadership, tips towards being accountable and committed leader.

Total Periods:30

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EXPERIENTIAL LEARNING

LIST OF EXPERIMENTS:

1. Collect the case studies related to successful leaders and their traits.
2. Different Case Studies Will be Given to students as per the topic that will be collected and evaluated.
3. The case studies will be collected as Assignments and the same will be evaluated.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Anderson T, *Transforming leadership*, St. Lucie Press, Boca Raton, FL, 2nd ed 1998
2. Babiak, P. & Hare, R.D., *Snakes in suits: when psychopaths go to work*, Regan Books, New York, 2006

REFERENCE BOOKS:

1. Conger J, *Inspiring others: Th e language of leadership,* Academy of Management Executive, 5(1), 31-45, 1991
2. *Leadership Skills*. MTD Training & Ventus Publishing ApS, 2010

VIDEO LECTURES:

1. Marshall Goldsmith: The Essentials Of Leadership (fs.blog)
2. https://onlinecourses.nptel.ac.in/noc23_mg28/preview

WEB RESOURCES:

1. cdn2.hubspot.net/hubfs/4654529/Expert landing pages/Peter Cox/Resources/10 Leadership Essentials .pdf
2. 3-leadership-essentials-discovery-event-w.-no.-05.11.12.pdf (imd.org)

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SCHOOL CORE
(Management Basket)

Course Code	Course Title	L	T	P	S	C
22MG101402	**ORGANIZATIONAL BEHAVIOUR**	2	-	-	-	2

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course enables the students to know the principles in an organization, the system and process of effective controlling in the organization.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1   Interpret the scope of organizational behavior and its significance.

CO2   Understand the managerial strategies in achieving the organizational goals of an organization

CO3   Demonstrate the impact of motivation and leadership in group dynamics.

CO4   Solve organizational conflicts through negotiation and team building.

CO5   Improve the results – performance outcome through human behavior and organizational behaviour can aid them in their purist of the goals.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	-	-	-	2	-	2	-	2	-	2
CO2	1	-	2	1	-	2	-	-	-	-	-	2
CO3	2	-	2	-	1	-	-	-	-	2	-	2
CO4	1	2	-	1	-	-	-	-	-	2	-	2
CO5	1	2	1	-	-	-	-	-	-	2	2	2
Course Correlation Mapping	2	2	2	3	2	2		2		2	2	2

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT

Module 1:   **INTRODUCTION**   *(06 Periods)*

Nature and scope – Linkages with other social sciences- Individual roles and organizational goals – perspectives of human behavior - Perception– perceptual process

Module 2:   **LEARNING**   *(06 Periods)*

Learning - Learning Process- Theories- (Pavlov, Skinner and Thorndike) - Personality and Individual Differences - Determinants of Personality - Values, Attitudes and Beliefs.

Module 3:   **MOTIVATION AND LEADERSHIP**   *(06 Periods)*

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Definition and nature of motivation, Theories of Motivation (Maslow, Alderfer) - Leadership – Traits-Styles –Leadership skills– Challenges to leaders.

Module 4:   ORGANIZATIONAL CONFLICTS   *(06 Periods)*

causes and consequences-conflict and Negotiation Team Building, Conflict Resolution in Groups and problem solving Techniques.

Module 5:   ORGANIZATIONAL COMMUNICATION   *(06 Periods)*

Communication, types and process, importance and barriers – Organizational change - change process - resistance to change – Organizational development and OD interventions.

Total Periods:30

EXPERIENTIAL LEARNING

LIST OF EXPERIMENTS:

1. Collect the case studies related to recent topics in OB and other Contemporary OB Practices and Present them as a seminar.
2. Different Case Studies Will be Given to students as per the topic that will be collected and evaluated.
3. The case studies will be collected as Assignments and the same will be evaluated.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Robbins.P. Stephen (2006), Organizational Behaviour, Pearson Education, New Delhi.
2. Luthans Fred (1998), Organizational Behaviour, Tata Mc Graw Hill International Edition, New Delhi
3. K.Aswathappa "Organizational Behaviour-Text, Cases and Games", HimalayaPublishingHouse, New Delhi, 2008.

REFERENCE BOOKS:

1. Steven L Mc Shane, Mary Ann Von Glinow, Radha R Sharma: "Organizational Behaviour",TMH Education, NewDelhi,2008
2. PareekUdai (2007), Understanding Organizational Behaviour, Oxford University Press, New Delhi
3. Jerald Greenberg and Robert.A. Baron, (2009), Organizational Behaviour, PHI learning Private Ltd., New Delhi.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=Sg64udtQ300&list=PL3Y_p3e-Lne2no2K5cNa8y7ti1uqCjZw8
2. https://www.youtube.com/watch?v=pHg3ZfGk5j0

WEB RESOURCES:

1. https://www.icmrindia.org
2. https://www.citeob.com/ 5 https://www.ob-guide.com

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SCHOOL CORE
(Management Basket)

Course Code	Course Title	L	T	P	S	C
22MG101403	**PROJECT MANAGEMENT**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: To understand the importance of decision-making while implementing any project and interpret and discuss the results of qualitative and quantitative analysis

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understand the basic introduction to project management

CO2 Apply the methods of project identification and selection.

CO3 Understand project allocation methods and evaluation.

CO4 Analyse the techniques for project time, review, and cost

CO5 Understand the factors of risk and quality of a project.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	2	1	-	-	-	-	-	-	-	-
CO2	1	1	2	2	-		2		1			-
CO3	2	2	1	2	1	-	-	1	-	-	2	
CO4	3	1	2	2	1	-	-	-	-	-	-	2
CO5	2	2	1	2	1	1	-	-	-	-	-	1
Course Correlation Mapping	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	1	**-**	**2**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION   *(05 Periods)*
Concept of project management, project definition and key features of projects, project life cycle phases, typical project management issues, basic project activities

Module 2:   PROJECT IDENTIFICATION AND SELECTION   *(06 Periods)*
Identification and screening (brainstorming, strength and weakness in the system, environmental opportunities and threats), Project evaluation methods- Payback period, Net present value, Internal rate of return and project evaluation under uncertainty.

Module 3:   PROJECT RESOURCE MANAGEMENT   *(07 Periods)*
Scheduling resources, resource allocation methods, project crashing and resource leveling,

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working of systems, design of systems, project work system design, project execution plan, project procedure manual project control system, planning scheduling and monitoring

Module 4: TIME AND COST MANAGEMENT   *(05 Periods)*
Time Management-Network diagram, forward and backward pass, critical path, PERT and CPM, AOA and AON methods, tools for project network, Cost management-earned value method

Module 5: RISK AND QUALITY MANAGEMENT   *(07 Periods)*
Risk identification, types of risk, risk checklist, risk management tactics, risk mitigation and contingency planning, risk register, communication management, Quality assurance and quality control, quality audit, methods of enhancing quality

Total Periods: 30

EXPERIENTIAL LEARNING

1. Refer to any video lecture on project evaluation methods and give a brief seminar using PPT

2. Select any company wherein you will get the details of activities and time and draw the project network diagram and submit a report.

3.

Activity	Predecessor Activity	Normal Time (Weeks)	Crash Time (Weeks)	Normal Cost (Rs.)	Crash Cost (Rs.)
A	-	4	3	8,000	9,000
B	A	5	3	16,000	20,000
C	A	4	3	12,000	13,000
D	B	6	5	34,000	35,000
E	C	6	4	42,000	44,000
F	D	5	4	16,000	16,500
G	E	7	4	66,000	72,000
H	G	4	3	2,000	5,000

Determine a crashing scheme for the above project so that the total project time is reduced by 3 weeks

4. Collect any case study that discusses the process of probability calculation of success of the project and submit a report

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. R.Panneerselvam and P.Senthil Kumar (2013), Project Management, PHI Learning Private Limited.
2. Prasanna Chandra (2014), Projects: Planning, Analysis, Selection, Financing, implementation, and Review.

REFERENCE BOOKS:

1. A Guide to the Project Management Body of Knowledge: (PMBOK Guide) by Project Management Institute, 2013.
2. Gopala Krishnan & Rama Murthy, A Text book of Project Management, McMillan India.

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3.   S. Choudhary (2004), Project Management, Tata McGraw Hill Publication.

VIDEO LECTURES:

1.   https://onlinecourses.nptel.ac.in/noc19_mg30/preview

2.   https://archive.nptel.ac.in/courses/110/104/110104073/

WEB RESOURCES:

1.   https://www.pmi.org/about/learn-about-pmi/what-is-project-management

2.   https://www.manage.gov.in/studymaterial/PM.pdf

3.   https://imada.sdu.dk/u/jbj/DM85/lec7.pdf

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SCHOOL CORE
(Mandatory Courses)

Course Code	Course Title	L	T	P	S	C
22LG107601	**PROFESSIONAL ETHICS AND HUMAN VALUES**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course deals with personal conviction, and ethics and describes the accepted principles and standards of conduct regarding moral duties and virtues as applied to an organization. Codes of professional ethics guide the stakeholders of an organization about the desirable and undesirable acts related to the profession.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the principles of ethics, professional values, and social responsibility.

CO2. Analyze the problems in the implementation of moral autonomy and use ethical theories in resolving moral dilemmas.

CO3. Develop suitable strategies to resolve problems that arise in practicing professional ethics and Industrial standards.

CO4. Function as a member, consultant, manager, advisor and leader in multi-disciplinary teams.

CO5. Provide solutions to complex problems associated with professional ethics using analysis and interpretation.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	2	2	2	2	-	-	-	1	1	1	1
CO2	2	3	2	-	2	2	2	2	2	-	-	-	1	1	1	1
CO3	2	-	3	-	2	2	2	2	2	-	-	-	1	1	1	1
CO4	2	-	-	-	-	2	2	2	2	-	3	-	1	1	1	1
CO5	2	2	3	2	-	3	2	2	2	-	-	-	1	1	1	1
Course Correlation Mapping	**2**	**3**	**-**	**-**	**2**	**2**	**2**	**2**	**2**	**-**	**3**	**-**	**1**	**1**	**1**	**1**

Correlation Levels: 3: High;   2: Medium;   1: Low

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COURSE CONTENT

Module 1:   PROFESSIONAL ETHICS   *(06 Periods)*

Scope and aim of ethics, Senses of ethics, Variety of moral issues, Types of inquiry, Moral dilemmas, Moral autonomy-Kohlberg's theory, Gilligan's theory, Consensus, and controversy.

Module2:   PROFESSIONAL IDEALS AND VIRTUES   *(06 Periods)*

Theories on virtues and ideals, Professions, Professionalism, Characteristics, Expectations, Professional responsibility, Integrity, Self-respect, Sense of responsibility, Self-interest, Customs and religion, Self-interest and ethical egoism, Customs and ethical relativism, Religion and divine command ethics, Use of ethical theories, Resolving moral dilemmas and moral leadership.

Module 3:   SOCIAL EXPERIMENTATION   *(06 Periods)*

Experimentation, Similarities to standard experiments, Learning from the past and knowledge gained, responsible experimenters, Conscientiousness, Moral autonomy and accountability, The challenger case, Codes of ethics and limitations, Industrial standards and Problems with the law of engineering.

Module 4:   RESPONSIBILITIES AND RIGHTS   *(06 Periods)*

Collegiality and loyalty, Respect for authority, Collective bargaining, Confidentiality, Conflict of interests, Occupational crime, Rights of engineers, Professional rights, Whistle-blowing, The BART case, Employee rights, and discrimination.

Module 5:   HARMONY WITH PROFESSIONALETHICS   *(06 Periods)*

Acceptance of human values; Ethical Human Conduct; Basis for Humanistic Education, Constitution, and Universal Order; Competence in professional ethics; Case studies: Holistic technologies, Management Models and Production Systems; Transition from the present state to Universal Human Order: socially and ecologically responsible engineers, technologists and managers - enriching institutions and organizations.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Demonstrate orally using your experiences of what is naturally acceptable in a relationship – Feeling of respect or disrespect and what is naturally acceptable is to nurture or exploit others.

2. Identify community partners and discuss with a community partner or organization. Prepare a report by identifying and analysing the issues or opportunities.

3. Field experiences may be directed to include a range of time-intensive endeavours that require varying levels of student interaction. Prepare a report on visiting a Juvenile home.

4. Students read a speech in the classroom by former United Nations Secretary-General Kofi Annan on human values.

5. Students are encouraged to bring a daily newspaper to class or to access any news related to the need for human values and note down the points.

6. Bring out the relevance of engineering ethics theory and practice with relevance to current trends.

7. Professional ideals and virtues are important to everyone. Prepare a case study on the professional ideals and virtue of any one of the famous sports personalities from India.

8. Compare the present to the past in engineering experimentations concerning the change in professionalism.

9. Make a study on occupational crime and the role of modern technology in finding solutions.

10. Prepare a case study on how to maintain harmony with different cultural people using professional ethics.

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(It's an indicative one. The course instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXTBOOKS:

1. Gaur R R, Sangal R & G P Bagaria, *Human Values and Professional Ethics*,Excel Books, New Delhi, 2010.

2. Govindarajan, M., Nata Govindarajan, M., Natarajan, S. and Senthilkumar, V. S., *Engineering Ethics*, Prentice Hall of India, 2004.

3. Mike W. Martin and Roland Schinzinger, *Ethics in Engineering*, Tata McGraw-Hill, 3rd Edition, 2007.

REFERENCE BOOKS:

1. S. Kannan and K. Srilakshmi, *Human Values and Professional Ethics*, Taxmann Allied Services Pvt Ltd., 2009.

2. Edmund G. Seebauer and Robert L. Barry, *Fundamental of Ethics for Scientists and Engineers*, Oxford University Press, 2001.

3. Charles F. Fledderman, *Engineering Ethics*, Pearson Education, 2nd Edition, 2004.

4. R. Subramanaian, *Professional Ethics*, Oxford Higher Education, 2013.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=jfGIq_EiXzI

2. https://www.youtube.com/watch?v=QFHOtH54oUc

3. https://www.youtube.com/watch?v=JJshY11nX14

4. https://www.youtube.com/watch?v=TyP09S0UEzA

5. https://www.youtube.com/watch?v=0QMwjV_ZVtc

WEB RESOURCES:

1. https://siiet.ac.in/wp-content/uploads/2020/09/7.1.10-professional-ethics-manual.pdf

2. https://soaneemrana.org/onewebmedia/Professional%20Ethics%20and%20Human%20Values%20by%20R.S%20NAAGARAZAN.pdf

3. https://india.oup.com/productPage/5591038/7421214/9780199475070

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SCHOOL CORE
(Mandatory Courses)

Course Code	Course Title	L	T	P	S	C
22CE107601	**ENVIRONMENTAL SCIENCE**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on natural resources, ecosystems, biodiversity, environment pollution and control, social issues and environment, human population and environment.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze natural resources to solve complex environmental problems and natural resource management considering society, environment and sustainability.

CO2. Analyze ecosystems and biodiversity to solve complex environmental problems by following environmental ethics considering society, environment and sustainability besides communicating effectively in graphical form.

CO3. Analyze various types of pollution and their control measures to solve environmental problems through appropriate tools and techniques following latest developments considering society, ethics, environment and sustainability.

CO4. Analyze social issues and its impact on environment, environmental acts to solve complex environmental problems considering society, environment and sustainability besides communicating effectively in graphical form.

CO5. Analyze human population and its impact on environment to solve complex environmentalproblems through team work and using appropriate tools and techniques considering ethics, society, environment and sustainability.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	-	2	-	1	1	-	-	-	1	-
CO2	3	3	-	2	-	1	1	1	-	1	-	-
CO3	3	3	-	2	1	1	1	1	-	-	-	1
CO4	3	3	-	3	-	1	1	1	-	1	-	-
CO5	3	3	-	2	1	1	1	1	1	-	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

Correlation Levels: 3: High;   2: Medium;   1: Low

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COURSE CONTENT

Module 1: NATURAL RESOURCES   *(07 Periods)*

Multidisciplinary nature of environment; Natural Resources: Renewable and non-renewable resources; Forest, Water, Mineral, Food and Energy resources -Causes, Effects, Remedies, Case studies; Role of an individual in conservation of natural resource and equitable use of resources for sustainable lifestyles.

Module 2: ECOSYSTEMS AND BIODIVERSITY   *(07 Periods)*

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem - Producers, Consumers, Decomposers; Food chains, Food webs, Ecological pyramids – Types; Characteristic features, Structure and functions of forest ecosystem, Desert ecosystem, Aquatic ecosystem.
Biodiversity: Concept and value of biodiversity, Role of biodiversity in addressing new millennium challenges, Hot spots of biodiversity, Threats to biodiversity, Man-wild life conflicts, Endemic, Endangered and extinct species of India, Conservation of biodiversity – In-situ and ex-situ.

Module 3 ENVIRONMENTAL POLLUTION AND CONTROL   *(06 Periods)*

Causes, Adverse effects and control measures of pollution - Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear pollution, Solid waste management – Urban waste, industrial waste; Latest developments in pollution control, Hazards and disaster management – Floods, Earthquakes, Tsunamis, Case studies.

Module 4 SOCIAL ISSUES AND THE ENVIRONMENT   *(06 Periods)*

Sustainable development, Urban problems related to energy, Environmental ethics –Issues, Solutions; Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and case studies, Wasteland reclamation, Consumerism and waste products, Concept of green technologies, Environment justice: National Green Tribunal and its importance; Environment protection act, Air act, Water act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation, Public environmental awareness.

Module 5 HUMAN POPULATION AND THE ENVIRONMENT   *(04 Periods)*

Population growth, Population characteristics and variation among nations, Population explosion, Family welfare programme, Environment and human health, Human rights, Value education, HIV/AIDS, Women and child welfare, Role of information technology in environment and human health; Case studies - Field Work/Assignment/Seminar on Environmental assets – Water bodies/Forest/Grassland/Hill/Mountain.

Total Periods: 30

EXPERIENTIAL LEARNING

1.   Visit a nearby villages and know the status of availability of local resources that can be improved through proper education.

2.   Make an awareness program in the villages for the development of natural resources, ecosystems and biodiversity.

3.   Prepare a document by visiting a local urban waste dumping yard near to the Tirupati city.

4.   Visit a local village and find a barren land and make the land into a useful land by planting plants or providing the soil and fertilizers required to improve the soil.

5.   Visit a local zoological park and identify the species variety and variability.

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(It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXT BOOKS:

1. Anubha Kaushik and Kaushik, C.P., *Perspectives in Environmental Studies*, New Age International (P) Ltd. Publications, 6th Edition, 2018.
2. Erach Barucha, *Environmental Studies,* Orient Blackswan, 3rd Edition, 2021.

REFERENCE BOOKS:

1. Cunningham, W. P. and Cunningham, M. A., *Principles of Environmental Science*, Tata McGraw-Hill Publishing Company, New Delhi, 8th Edition, 2016.
2. Benny Joseph, *Environmental Studies*, Tata McGraw-Hill, 2nd Edition, 2009.
3. Anji Reddy, M., *Text Book of Environmental Science and Technology*, BS Publications, Revised Edition, 2014.
4. Rajagopalan, R., *Environmental Studies*, Oxford University Press, 3rd Edition, 2015.

VIDEO LECTURES:

1.   http:// nptel.ac.in/courses/109/104/109104047

2.   https://www.youtube.com/watch?v=mIPBPG-5dUw

WEB RESOURCES:

1.   https://nptel.ac.in/courses/122102006

2.   https://www.flame.edu.in/academics/ug/program-structure/major-minor-courses/environmental-studies

3.   https://www.tutorialspoint.com/environmental_studies/environmental_studies_environment.htm

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SCHOOL CORE

(Mandatory Courses)

Course Code	Course Title	L	T	P	S	C
22CE107602	**DISASTER MITIGATION AND MANAGEMENT**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on disasters, earthquakes, floods, cyclones, droughts, landslides and disaster management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze the vulnerability of an area to natural and man-made disasters/hazards as per the guidelines to solve complex problems using appropriate techniques ensuring safety, environment and sustainability.

CO2. Propose appropriate mitigation strategies for earthquake and tsunami impacts as per code of practice using suitable techniques ensuring safety, environment and sustainability besides communicating effectively in graphical form.

CO3. Analyze the causes and impacts of floods, cyclones and droughts using appropriate tools and techniques and suggest mitigation measures ensuring safety, environment and sustainability besides communicating effectively in graphical form.

CO4. Analyze the causes and impacts of landslides using appropriate tools and techniques and suggest mitigation measures ensuring safety, environment and sustainability.

CO5. Design disaster management strategies to solve pre, during and post disaster problems using appropriate tools and techniques following the relevant guidelines and latest developments ensuring safety, environment and sustainability besides communicating effectively in graphical form.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	-	2	2	2	2	2	-	-	-	-
CO2	3	3	3	3	2	2	1	2	-	2	-	-
CO3	3	3	-	2	2	2	2	-	-	2	-	-
CO4	3	3	-	3	2	2	2	-	-	-	-	-
CO5	3	2	3	2	2	2	1	2	-	1	3	2
Course Correlation Mapping	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**2**	**3**	**2**

Correlation Levels: 3: High;   2: Medium;   1: Low

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COURSE CONTENT

Module 1:   DISASTERS   *(06 Periods)*

Types of disasters - Natural disasters; Impact of disasters on environment, infrastructure and development; Concepts of hazards and vulnerability analysis, Hazard Assessment, Guidelines for hazard assessment and vulnerability analysis, Basic principles and elements of disaster mitigation.

Module 2:   EARTHQUAKES   *(06 Periods)*

Introduction to earthquake, Intensity scale (MSK–64), Seismic zones and activity in India, Action plan for earthquake disaster preparedness, Elements at risk, Recovery and rehabilitation after earthquake, Concepts of Earthquake resistant design and construction of buildings; Tsunami – Onset, Types and causes, Warning, Elements at risk, Typical effects, Specific preparedness and mitigation strategies, Case studies.

Module 3:   FLOODS, CYCLONES AND DROUGHTS   *(07 Periods)*

Floods and Cyclones: Onset, Types, Causes, Warnings, Elements at risk, Typical effects, Indian floods and cyclones, Hazard zones, Potential for reducing hazards, Mitigation strategies and community based mitigation, Case studies.
Droughts: Onset, Types and warning; Causes, Impact, Early warning and response mechanisms, Mitigation strategies, Droughts in India, Case studies.

Module 4:   LANDSLIDES   *(06 Periods)*

Onset, Types and warning; Causes, Elements at risk, Indian landslides, Hazards zones, Typical effects, Mitigation strategies and community based mitigation, Case studies.

Module 5:   DISASTER MANAGEMENT   *(05 Periods)*

Disaster management organization and methodology, Disaster management cycle, Disaster management in India – Typical cases and Cost–benefit analysis, Disaster management programs implemented by NGOs and Government of India, Usage of GIS and Remote sensing techniques in disaster management, Leadership and Coordination in Disaster management, Emerging trends in disaster management.

Total Periods: 30

EXPERIENTIAL LEARNING

1.   Perform hazard assessment and vulnerability analysis for any nearby town/city and prepare a detailed report of possible impacts of various disasters on environment, infrastructure and development.

2.   Prepare a detailed report on the causes and effects of Tsunami that was occurred in the year 2004. Also discuss various advancements in Tsunami warning systems.

3.   Identify the major causes of urban floods in cities like Chennai, Hyderabad & Mumbai and submit a report along with various mitigation strategies to reduce the impact of floods.

4.   Prepare a detailed report on how various man-made activities are directly/indirectly related to the occurrence of landslides that occurred in recent days in India.

5.   Visit AP State Disaster Response and Fire Services Department and record about various methods used by them in mitigating disasters and their management.

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RESOURCES

TEXT BOOKS:

1. Sharma V. K., *Disaster Management, Medtech Publishing*, 2nd Edition, 2013.

2. Anand S. Arya, Anup Karanth, and Ankush Agarwal, *Hazards, Disasters and Your Community: A Primer for Parliamentarians*, GOI–UNDP Disaster Risk Management Programme, Government of India, National Disaster Management Division, Ministry of Home Affairs, New Delhi, Version 1.0, 2005

REFERENCE BOOKS:

1. Donald Hyndman and David Hyndman, *Natural Hazards and Disasters*, Cengage Learning, USA, 5th Edition, 2015.
2. *Disaster Management in India,* A Status Report, Ministry of Home Affairs, Govt. of India, May 2011.
3. Rajendra Kumar Bhandari, *Disaster Education and Management: A Joyride for Students, Teachers, and Disaster Managers*, Springer India, 2014.
4. Singh R. B., *Natural Hazards and Disaster Management*, Rawat Publications, 2009.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/105104183

2. https://www.digimat.in/nptel/courses/video/124107010/L01.html

WEB RESOURCES:

1. https://egyankosh.ac.in/handle/123456789/25093

2. https://www.egyankosh.ac.in/handle/123456789/25912

3. https://www.nios.ac.in/media/documents/333courseE/12.pdf

4. https://ndmindia.mha.gov.in/images/public-awareness/Primer%20for%20Parliamentarians.pdf

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CE107603	**RURAL TECHNOLOGY**	2	-	-	-	2

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion ontechnology for rural development, nonconventional energy, technologies for rural development, community development and it in rural development.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Compare various technologies for rural development by solving rural problems through different schemes by considering ethics, society, environment and sustainability.

CO2. Analyze non conventional energy sources using appropriate tools and techniquesto solve rural energy problems considering society, environment andsustainability besides communicating effectively in graphical form.

CO3. Select appropriate technologies in different areas of rural development to solve rural issues following latest developments considering society, environment and sustainability.

CO4. Relate water conservation, health, safety and rural employment issues for community development to solve rural problems through appropriate technologies considering ethics, society, environment and sustainability.

CO5. Analyze the impact of IT, public and private partnership on rural development to solve complex rural problems using appropriate tools and techniques considering ethics, society, environment and sustainability.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	3	2	1	1	1	-	-	-	-
CO2	2	3	-	2	2	1	1	-	-	1	-	-
CO3	2	3	-	2	2	1	1	-	-	-	-	1
CO4	2	3	-	2	2	1	2	1	-	-	-	-
CO5	2	3	-	3	2	1	1	1	-	-	-	-
Course Correlation Mapping	2	3	-	3	2	1	2	1	-	1	-	1

Correlation Levels: **3: High;   2: Medium;   1: Low**

COURSE CONTENT

Module 1:   INTRODUCTION TO RURAL DEVLOPMENT   *(06 Periods)*
India - Technology and rural development, Pre and post-independence period, Rural India Life, Indian farmer, Role of science and technology in rural development, Rural technology and poverty eradication, Rural business hubs, Technology in improving rural infrastructure, Various organizations related to innovation, Issues of technology transfer - CAPART, NABARD, CSIR, NIF.

Module 2:   NON CONVENTIONAL ENERGY   *(06 Periods)*
Definition of energy, Types of alternative sources of energy, Sources of non-conventional energy – Solar energy: Solar pump in agriculture, Solar dryer, Solar cooker, Solar heater; Biogas, Recycling and management, Wastes conservation, Assessment and production of

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biomass products and their utilization.

Module 3   TECHNOLOGIES FOR RURAL DEVELOPMENT   *(06 Periods)*
Food and agro based technologies, Tissue culture, Nursery, Building and construction technologies, Cultivation and processing of economic plants, Cottage and social industries, Latest developments in rural technologies.

Module 4   COMMUNITY DEVELOPMENT   *(06 Periods)*
Water conservation, Rain water Harvesting, Drinking water Standards and simple treatments used, Environment and Sanitation, Bio fertilizers, Medical and aromatic plants, Employment generating technologies–Apiculture, Pisciculture, Aquaculture.

Module 5   IT IN RURAL DEVELOPMENT   *(06 Periods)*
Role of information technology (IT) in rural areas, Impact of IT in rural development, Need and necessity of technology, Corporate social responsibilities, Private sector participation (Activities in different spheres: Employment, Education, Health, Agriculture and service sectors) and Saansad Adarsh Gram Yojana (SAGY), Village adoptionschemes.

Total Periods: 30

EXPERIENTIAL LEARNING
1.   Visit a nearby village and know the status of small scale industries which are implanted and to be established based on the availability of the local resources.
2.   Visit a local village and make an awareness program on energy utilization using biomass products.
3.   Make a awareness program in the villages for the rural development in terms of home-made products.
4.   Construct rain water harvesting structures in nearby villages where water scarcity is more and prepare a document.
5.   Develop a small IT application the village area which will be used for the growth of the village.

(It's an indicative one. The course instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXT BOOKS:
1. Virdi, M. S., *Sustainable Rural Technologies*, Daya Publishing House, 2nd Edition 2018.
2. Prabhath, S. V. and P. Ch. Sita Devi, *Technology and Rural India*, Serials Publications, 1st Edition, 2012

REFERENCE BOOKS:
1. Chakravarthy, R., and Murthy, P. R. S., *Information Technology and Rural Development*, Pacific Book International, 1st Edition, 2012.
2. Shivakanth Singh, *Rural Development Policies and Programmes*, Northern Book Centre, 1st Edition, 2002.
3. Katar Singh, and Anil Shishodia*, Rural Development: Principles, Policies, and Management,* SAGE Publications India Private Limited, 4th Edition, 2016.
4. Vinayak Reddy, A. and YadagiraCharyulu, M., *Rural Development in India: Policies & Initiatives,* New Century Publications, 1st Edition, 2008.

VIDEO LECTURES:
1.   http://nptel.ac.in/courses/109/104/109104047
2.   https://www.youtube.com/channel/UCEZxAQu3ZBulN-pYMYO2i_A/videos
3.   https://www.youtube.com/watch?v=HnrIB-QmvlQ

WEB RESOURCES:
1.   en.wikibooks.org/wiki/Technologies_for_Rural_Development/Complete
2.   https://www.oecd-ilibrary.org/sites/ae6bf9cd-en/index.html?itemId=/content/component/ae6bf9cd-en
3.   https://crdt.iitd.ac.in/

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SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG107603	**SPOKEN ENGLISH**	-	1	2	-	2

Pre-Requisite
English for Professionals

Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course deals with the development of fluency and intelligibility in spoken English. Through individual and group activities, students work on improving pronunciation, practicing conversation strategies, and delivering oral presentations.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Demonstrate knowledge of functional English for effective communication.
CO2. Analyze different types of vocabulary for fluency in communication
CO3. Apply correct usage of English grammar in writing and speaking.
CO4. Apply speaking strategies in terms of usage of English with accuracy, appropriacy, and fluency.
CO5. Analyze techniques to use communication skills for effective presentation.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	2	-	3	-	-	-
CO2	2	3	-	-	-	-	2	-	3	-	-	-
CO3	2	-	3	-	3	-	2	-	3	-	-	-
CO4	2	-	-	-	3	-	2	-	3	-	-	-
CO5	2	3	2	-	3	-	2	-	3	-	-	-
Course Correlation Mapping	**2**	**3**	**3**	**-**	**3**	**-**	**2**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   FUNCTIONAL ENGLISH   *(06 Periods)*

Concepts of Functional Spoken English, Self-Introduction; Listening and Speaking: Do's and Don'ts; Expressions: Ability, Admiration, Agreement, Annoyance, Appreciation, Pleasure, Sarcasm, Satisfaction, Surprise, Approval, Certainty, Doubt, Gratitude, Possibility, Fear, Worry, Condolences; Asking for: Advice, Clarification, Direction, Information, Permission; Making: Predictions, recommendations

Module 2:   VOCABULARY BUILDING   *(06 Periods)*
Vocabulary for day-to-day conversations: Vegetables, Groceries, Fruits, Weather, Parts of a Human body, Dresses, Furniture; Relations: Birds, Cries of Animals, Food, Hospitality, Houses, Rooms, Tools, Airport, News Paper, Books, Gems, Corporate Vocabulary, Jobs, Occupations, Diseases; British and American spelling; Slang Words and Technical Jargons.

Module 3:   FUNCTIONAL GRAMMAR - I   *(06 Periods)*
English Grammar and the Indian Student, Parts of Speech, Verb forms: Tenses, Voice and Speech.

Module 4:   FUNCTIONAL GRAMMAR -II   *(06 Periods)*
Universal Auxiliaries: Sentence Structure, WH Questions, framing of Questions with answers; Question Tags, Subject and verb agreement, Spotting Errors.

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Module 5:   COMMUNICATION SKILLS: *(06 Periods)*

Polite, Courteous and diplomatic expressions, Good manners and Etiquette, Conversation Techniques, Narrating Stories.

                                                                         Total Periods: 30

EXPERIENTIAL LEARNING

1. Critically analyse the value of Indian money and its impact on the common man and Prepare a PowerPoint Presentation.

2. Prepare a conversation between you and a sanitary officer regarding sanitary conditions in your locality.
3. The English Language has a rich vocabulary and it increases day by day. Present a seminar on the norms adhered to in adding new words and list out the words added in the last five years with their meaning.
4. Enact roleplays in different situations.
5. Participate in group discussions and debate on present issues
6. A conversation is an exchange of ideas, thoughts, and feelings between two or more persons. Explain it with suitable examples
7. Prepare a schedule and identify various committees to be formed for celebrating the Annual Day of a college and explain team involvement in the celebration.
8. Gather various ideas on discussing with parents the role of higher education and job opportunities.
9. Imagine you see a person wasting water. Write a dialogue objecting to such wastage of natural resources.
10. Since social media offers a wide reach easily, it becomes easier for bullies to spread gossip or issue threats. How do you think Cybercrime is a menace brought about by social media?

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UNIVERSITY ELECTIVE

CourseCode	CourseTitle	L	T	P	S	C
22LG107602	**ESSENTIAL LIFE SKILLS FOR HOLISTIC DEVELOPMENT**	2	-	-	-	2

COURSE DESCRIPTION: This course deals with the enhancement of employability skills and maximizes the potential by introducing the principles that are for personal and professional success,and helping to apply them in their lives and careers.

COURSE OUTCOMES: After successful completion of the course, the students will be able to:

CO1. Demonstrate life skills required in personal and professional life.

CO2. Analyse well-defined techniques to cope with emotions and stress.

CO3. Apply appropriate thinking and problem-solving methods to solve problems.

CO4. Function effectively in a team and as an individual.

CO5. Demonstrate the qualities of an effective leader.

CO-PO Mapping Table:

Course Outcomes	ProgramOutcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	2	-	2	-	-	-
CO2	2	3	-	-	2	-	2	-	2	-	-	-
CO3	2	3	2	-	-	-	2	-	2	-	-	-
CO4	2	2	-	-	2	-	2	-	2	-	3	-
CO5	2	2	-	-	-	-	2	-	2	-	-	-
Course Correlation Mapping	2	3	2	-	2	-	2	-	2	-	3	-

CorrelationLevels: 3:High;   2: Medium;   1:Low

COURSE CONTENT

Module 1: OVERVIEW OF LIFE SKILLS   *(06 Periods)*
Meaning and significance of life skills, Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem-solving, Effective Communication,interpersonalrelationships,copingwith stress, coping with emotion.
Ethics, Moral and Professional Values: Human Values, Civic Rights, Engineering Ethics, Engineering as Social Experimentation, EnvironmentalEthics, Global Issues, Code of Ethics like ASME, ASCE, IEEE.

Module 2: STRESS MANAGEMENT   *(06 Periods)*
Stress Management: Stress, reasons, and effects, identifying stress, stress diaries, the four A's of stress management, techniques, **Approaches**: action-oriented, emotion-oriented, acceptance oriented, resilience, Gratitude Training, **Coping with emotions**: Identifying and managing emotions, harmful ways of dealing with emotions, PATH method, and relaxation techniques.

Module 3: TRANSFORMATIONAL SKILLS   *(06 Periods)*
Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Functions of Left Brain and Right brain, Convergent and Divergent Thinking, Critical reading and Multiple Intelligence.

Module 4: GROUP AND TEAM DYNAMICS *(06 Periods)*
Introduction to Groups: formation of the group, thinking strategies, Clarifying expectations, Problem Solving, Consensus, Dynamic techniques, Group vs Team, Team Dynamics, and Virtual Teams. Managing team performance and managing conflicts, Intrapreneurship.

Module 5: LEADERSHIP *(06 Periods)*
Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions. Growing as a leader, managing diverse stakeholders, crisis management. Typesof Leadership, Traits, Styles, VUCA Leadership, Levels of Leadership, Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Prepare an attitude test by making small groups in the class and measure the attitudes of students in your class.
2. Students are psychologically pressurized for qualifying in campus interviews. Prepare a Cases tudy on the Campus Interview pressure and stress of students using SWOT analysis.
3. Record and prepare a video presentation on people of different cultures and make a commenton their accents.
4. The qualities of the leaders play an important role in their success. Prepare a short film about a leader and list out the best qualities.
5. In the present context, so cialmedia plays a vital role in the success of leaders and the wide spread of their principles. Prepare a presentation on the impact of social media on a success of a leader.
6. 'Knowledge of present technologies helps us to live a harmonious life.'
Make a video to justify the statement.
7. Prepare a Power Point presentation on life skills needed in our day-to-day life and their importance.
8. Every person wants to be successful in their personal and professional life and apply various strategies for that. List out the strategies to become successful in one's professional life.
9. A boy/girl who is a neighbor feels depressed for not being given with mobile for playing video games. Find methods and solutions to overcome theself-pity of the boy/girl.

10. Identify the persons who are irregular to class. Findout their problems and comeup with solutions.
(Note:It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:
1. Dr.K Alex*, Soft Skills*, SChand & Company Pvt. Ltd, 2013.
2. Monmohan Joshi, *Soft Skills. Boolkboon.com*, 1stEdition, 2017.

REFERENCE BOOKS:

1. Agna Fernandez, *Generic Skills for Employability*, Cambridge University Press, 2020.
2. Larry James,*The First Bookof Life Skills*, Embassy Books, 1st edition, 2016.
3. Shiv Khera,*You Can Win*, Macmillan Books, NewYork, 2003.
4. Barun K. Mitra, *Personality Development and Soft Skills*, Oxford Publishers, 3rd impression, 2017.
5. ICT Academy of Kerala, *Life Skills for Engineers*, McGraw Hill Education (India) PrivateLtd.,2016.
6. David R.Caruso, *The Emotionally Intelligent Manager How to Develop and Use the Four Key Emotional Skills of Leadership*, JohnWiley & Sons,2004.
7. Kalyana, *Soft Skill for Managers*, Wiley Publishing Ltd,1stedition, 2015.

8. Larry James, *The First Book of Life Skills*, EmbassyBooks,1st edition, 2016.
   Shalini Verma, *Development of Life Skills and Professional Practice*, Sultan Chand(G/L)& Company,1st edition,2014.

10. Daniel Goleman, *Emotional Intelligence*, Bantam,2006.

11. Remesh S.,VishnuR.G., *Life Skills for Engineers*, Ridhima Publications, 1st edition, 2016.

12. Butterfield Jeff, *Soft Skills for Everyone*, Cengage Learning India Pvt Ltd, 1st edition, 2011.

13. *Training in Interpersonal Skills: Tips for Managing People at Work*, Pearson Education, India,6th edition,2015.

14. *The Ace of Soft Skills : Attitude, Communication and Etiquette forr Success*, Pearson Education, 1st edition, 2013.

VIDEO LECTURES:
1. https://www.youtube.com/watch?v=xM0fajUl7Bg
2. https://www.youtube.com/watch?v=HwLK9dBQn0g
3. https://www.youtube.com/watch?v=sxX5LoojdJw
4. https://www.youtube.com/watch?v=xJBgqW9-lzc
5. https://www.youtube.com/watch?v=QVwTVM1Iv1c

WEB RESOURCES:
1. https://www.clarke.edu/campus-life/health-wellness/counseling/articles-advice/developing-a-positive-attitude/
2. https://www.skillsyouneed.com/ps/personal-swot-analysis.html
3. https://ecampusontario.pressbooks.pub/profcommsontario/chapter/cross-cultural-communication/
4. https://thepeakperformancecenter.com/educational-learning/thinking/#:~:text=There%20are%20several%20core%20thinking,storing%20an d%20then%20retrieving%20information.
5. https://www.webmd.com/anxiety-panic/guide/stage-fright-performance-anxiety

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MG107401	**INNOVATION, INCUBATION, AND ENTREPRENEURSHIP**	2	-	-	-	2

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course sensitize students on the prospects, opportunities, and challenges in entrepreneurship and the potential for value creation from prospective idea

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the basics of generating new business ideas
CO2. Explain the concept of design thinking and product innovation.
CO3. Illustrate the roles of digital technology in entrepreneurship.
CO4. Understand the need for start-up economics and market conditions
CO5. Evaluate the reasons for successful entrepreneurship.

CO-PO Mapping Table:

Course Outcomes	ProgramOutcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	-	-	-	-	-	-	-	-
CO2	1	1	1	-	-	-	-	1				-
CO3	2	2	1	-	-	-	-	1	-	-	2	
CO4	3	1	1	-	-	-	-	-	-	-	-	1
CO5	2	2	-	-	-	1	-	-	-	-	-	1
Course Correlation Mapping	**2**	**2**	**1**	**1**	**-**	**1**	**-**	**1**	1	**-**	**2**	**1**

CorrelationLevels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT

Module 1: INTRODUCTION   *(06 Periods)*
Concept and Definition, Taking product or service ideas to creating value: Why should one choose to become an entrepreneur, Entrepreneurial mind-set, Intrapreneurship

Module 2: PRODUCT INNOVATION   *(06 Periods)*
Product innovation process, engineering design process and the concept toffrugal engineering for developing innovative affordable products, effective user-interface.

Module 3: DIGITAL TECHNOLOGY ENTREPRENEURSHIP   *(06 Periods)*
Industry4.0landscapeandinnovationsusingdigitaltechnologieslikeAI, IOT, AR/VR, Cloud, SAAS, User Applications.

Module4: START UP ECONOMICS & MARKET CONSIDERATIONS   *(06 Periods)*
Economic consideration for starting a venture, Understanding Feasibility analysis, Understandingmarket,targetingcustomerandpositioningproduct

Module5: SUCCESSFUL BUSINESS INCUBATION   *(06 Periods)*
Business model innovation, Business process management, competitive advantages, Business model canvas, Bootstrapping.

Total Periods: 30

EXPERIENTIAL LEARNING

1.   Create and present a proto type of a new product of your choice.
2.   Present atleast three cases of successful business Ideas inrecent times
3.   Discuss in the group Entrepreneurship opportunities in terms of Orientation and Developmentation.
(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:
1.   Robert D.Hisrich, *Entrepreneurship,*
2.   Kuratko & Hodgetts, *Entrepreneurship-Theory, Process &Practice*, Thompson South- Western Publication

REFERENCE BOOKS:
1.   Peter Drucker, *Innovation and Entrepreneurship*, Harper Collins
2.   Thomas N. Duening, Robert D. Hisrich and Michael A. Lechter, *Technology Entrepreneurship Taking Innovation to the Marketplace*, Elsevier
3.   Prof. Nigel Cross, *Bloomsbury Design Thinking Understanding How Designers Think and Work*, 2019 Edition

VIDEO LECTURES:
1.   https://onlinecourses.nptel.ac.in/noc21_mg63/preview
2.   https://onlinecourses.nptel.ac.in/noc22_de08/preview

WEB RESOURCES:
1.   https://ciie.iitism.ac.in/files/CIIE-POLICY.pdf
2.   https://www.nios.ac.in/media/documents/249_Enterpreneurship/English_pdf/249_Enterpreneurship_Lesson_16.pdf

SCHOOL CORE

CourseCode	CourseTitle	L	T	P	S	C
22EE107001	**INTELLECTUAL PROPERTY RIGHTS**	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: The course is designed to provide comprehensive knowledge to the students regarding the general principles of intellectual property rights, Concept and Theories, Criticisms of Intellectual Property Rights, International Regime Relating to IPR. The course provides an awarenesson how to protect ones unique creation, claim ownership, knowledge of what falls under the purview of someone's rights and what doesn't,and safe guard the ir creations and ga in a competitive edge over the peers.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the need and the concepts of intellectual property right and avenues for filling intellectual property rights.

CO2. Understand the legislative practices and protocols for acquisition of trademark and the judicial consequences for violating laws of trademark protection.

CO3. Understand the legislative practices and protocols for acquisition of copyrights and the judicial consequences for violating laws of copyrights protection.

CO4. Understand the fundamentals of patent laws, legislative practices and protocols for acquisition of trade secrets and the judicial consequences for violating laws of trade secrets protection.

CO5. Understand the importance of geographical indications and various laws and protocols for protecting geographical indications.

CO-PO Mapping Table:

Course Outcomes	ProgramOutcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1
CO1	3	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	-	1	-	-	3	-	-	-	2
CO3	3	-	-	-	1	-	-	3	-	-	-	2
CO4	3	-	-	-	1	-	-	3	-	-	-	2
CO5	3	-	-	-	1	-	-	3	-	-	-	2
Course Correlation Level	3	-	-	-	1	-	-	3	-	-	-	2

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS   (06 Periods)

Introduction and the need for intellectual property rights (IPR); types of intellectual property- Design; International organizations, agencies and treaties.

Module 2: TRADEMARKS *(06 Periods)*

Introduction to trademark, Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

Module 3: LAW OF COPYRIGHTS *(06 Periods)*

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

Module 4: TRADE SECRETS *(06 Periods)*

Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.
Unfair competition: Misappropriation right of publicity, false advertising.

Module 5: GEOGRAPHICAL INDICATIONS *(06 Periods)*

The Geographical indications law in India, The objectives and features, the registry of geographical indications powers and functions. Types of goods offered. Protection: Agriculture goods, manufactured goods and natural goods. Registration of indications and the requirements. Prohibition of misleading use of indications of geographical origins, prohibition of dilution of geographical origins.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Should conduct a survey based on the real scenario, where IPR is misused or unethically used and present an article.

2. Prepare an article on the registration processes of IPR practically (copy right/trade mark/ patents).

3. Should study a case of conflict on trademarks/patents and should produce an article mentioning the circumstances and remedial measures.

4. Prepare an article on the latest development in the international intellectual property rights.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

TEXT BOOKS:

1. Deborah, E. Bouchoux, *Intellectual property: The law of Trademarks, Copyright, Patents, and Trade Secrets,* Cengage learning, 4th Edition, 2013.
2. PrabuddhaGanguli, *Intellectual property right - Unleashing the knowledge economy*, Tata McGraw Hill Publishing Company Ltd.
3. Marsha AEchols, *Geographical Indications for Food Products*, Wolters, 2008

REFERENCE BOOKS:

1. Neeraj P., &Khusdeep D., *Intellectual Property Rights,* PHI learning Private Limited, 1st Edition, 2019.
2. Nithyananda, K V., *Intellectual Property Rights: Protection and Management,* Cengage Learning India Private Limited, 2019.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/110105139

WEB RESOURCES:

1. Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
2. World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf
3. Cell for IPR Promotion and Management (http://cipam.gov.in/)
4. World Intellectual Property Organisation (https://www.wipo.int/about-ip/en/)
5. Office of the Controller General of Patents, Designs & Trademarks (http://www.ipindia.nic.in/)

SCHOOL CORE

CourseCode	CourseTitle	L	T	P	S	C
22EE107002	**FUNDAMENTALSOFRESEARCH METHODOLOGY**	2	-	-	2	2

COURSE DESCRIPTION: The course is developed for the students' to understand the underlying concepts of research methodology and a systematic approach for carrying out research in the domain of interest. The course is emphasised on developing skills to recognise and reflect the strength and limitation of different types of research; data collection methods, methods of Processing and analysing data. The course also emphasises on interpreting the findings and research articulating skills.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understands the underlying concepts of research methodology, types of research and the systematic research process.

CO2. Understand the philosophy of research design, types of research design and develop skills for a good research design.

CO3. Understand the philosophy of formulation of research problem, methods of data collection, review of literature and formulation of working hypothesis.

CO4. Understand various data processing and analysing techniques and their significance in research.

CO5. Develop skills to interpret the findings and research articulating skills along with the ethics of research.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	1	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	2	1	-	-	-	-	-	-
CO4	3	2	-	-	3	1	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	3	3	-	-
Course CorrelationLevel	3	2	1	-	3	1	-	-	3	3	-	-

CorrelationLevels: 3:High;   2: Medium;   1:Low

COURSE CONTENT

Module 1:   INTRODUCTION TO RESEARCH METHODOLOGY   *(06 Periods)*

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, and Significance of Research, Research and Scientific Method, Research Process, Criteria of Good Research.

Module 2:   RESEARCH DESIGN   *(06 Periods)*

Research design—Basic Principles, Need of research design, Features of good design, Important concepts relating to research design, Different research designs, Basic principles of experimental designs, Developing a research plan.

Module 3:   RESEARCH FORMULATION   *(06 Periods)*

Defining and formulating the research problem - Selecting the problem - Necessity of

defining the problem - Importance of literature review in defining a problem – Data collection – Primary and secondary sources; Critical literature review – Identifying gap areas from literature review, Development of working hypothesis.

Module 4:   PROCESSING AND ANALYSIS OF DATA   *(06 Periods)*

Processing Operations, Elements/Types of Analysis, Statistics in Research, Measures of Central Tendency, Measures of Dispersion, Measures of Relationship, Simple Regression Analysis.

Module 5:   INTERPRETATION AND REPORT WRITING   *(06 Periods)*

Interpretation: Meaning of interpretation; Techniques of interpretation; Precautions in Interpretation.
Report Writing: Significance, Different Steps, Layout, Types of reports, Mechanics of Writing a Research Report, Precautions in Writing Reports.

Total Periods: 30

EXPERIENTIAL LEARNING

1.   Should conduct a survey based on a hypothesis, analyze the data collected and draw the inferences from the data.

2.   Should review the literature on the given topic and should identify the scope/gaps in the literature and develop a research hypothesis.

3.   Should study a case, formulate the hypothesis and identify an appropriate testing technique for the hypothesis.

4.   Study an article and submit a report on the inferences and should interpret the findings of the article.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1.   C.R. Kothari, *Research Methodology: Methods and Techniques*, New Age International Publishers, 2nd revised edition, New Delhi, 2004.
2.   Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., *An introduction to Research Methodology*, RBSA Publishers, 2002.

REFERENCE BOOKS:

1.   R. Panneerselvam, *Research Methodology*, PHI learning Pvt. Ltd., 2009.

2.   Singh, Yogesh Kumar, *Fundamental of research methodology and statistics*, New Age International, 2006.

VIDEO LECTURES:

1.   https://nptel.ac.in/courses/121106007

2.   https://onlinecourses.nptel.ac.in/noc22_ge08/preview

3.   https://www.youtube.com/watch?v=VK-rnA3-41c

WEB RESOURCES:

1.   https://www.scribbr.com/category/methodology/

2.   https://leverageedu.com/blog/research-design/

3.   https://prothesiswriter.com/blog/how-to-formulate-research-problem

4.   https://www.formpl.us/blog/hypothesis-testing

5.   https://www.datapine.com/blog/data-interpretation-methods-benefits-problems/

6.   https://leverageedu.com/blog/report-writing/

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22AI101001	**DISCRETE MATHEMATICAL STRUCTURES**	3	-	-	-	3

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion on discrete mathematics to make students to think logically and mathematically and apply these techniques in solving problems. Topics include mathematical logic, functions, relations, deterministic algorithms and analysis techniques based on counting methods, recurrence relations, trees and graphs.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply mathematical logic and truth tables to validate precise statements.

CO2. Understand the concepts of sets, relations and functions.

CO3. Analyze and apply the concepts of mathematical induction, counting principles and properties of algebraic structures to solve computational Problems.

CO4. Formulate problems and solve recurrence relations using substitution method and generating functions.

CO5. Apply trees and graphs to solve the problems in computer applications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	2	2	-	-	-	-	-	-	-	3	-	-	-
CO2	3	-	-	2	2	-	-	-	-	-	-	-	3	-	-	-
CO3	3	3	-	3	2	-	-	-	-	-	-	-	3	-	-	-
CO4	3	2	-	3	2	-	-	-	-	-	-	-	3	-	-	-
CO5	3	-	-	3	2	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	**3**	**3**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: **3: High;   2: Medium;   1: Low**

COURSE CONTENT

Module 1: MATHEMATICAL LOGIC AND NORMAL FORMS   *(08 Periods)*

Mathematical Logic: Introduction, Statements and Notation, Connectives, Well- formed formulae, Truth tables, Tautology, Equivalence, Implications.
Normal forms: Disjunctive normal form, Conjunctive normal form, Principle disjunctive normal form, Principle conjunctive normal form.

Module 2: RELATIONS AND FUNCTIONS   *(08 Periods)*

Relations: Cartesian product of sets, Relations, Properties of binary relations, Equivalence, Compatibility and Partial ordering relations, Hasse diagram and related applications, Lattices as partially ordered sets, Definition and examples, Properties of Lattices.
Functions: Types of functions, Composition of functions and inverse of functions

Module 3: INDUCTION, COUNTING AND ALGEBRAIC STRUCTURES   *(09 Periods)*

Induction, Counting: Mathematical Induction – The Basics of Counting - The Pigeonhole Principle - Principle of Inclusion-Exclusion.
Algebraic Structures: Algebraic systems, Examples and general properties, Semi groups and Monoids, Groups, Subgroups, Homomorphism, Isomorphism

Module 4: GENERATING FUNCTIONS AND RECURRENCE RELATIONS   *(11 Periods)*

Generating Functions: Generating functions of sequences, Calculating coefficients of generating functions.
Recurrence Relations: Recurrence relations, Solving recurrence relations by substitution and generating functions, The method of characteristic roots, Solutions of homogeneous recurrence relations.

Module 5: GRAPHS AND TREES   *(09 Periods)*

Graphs: Basic concepts of Graph theory, Planar and Complete graph, Matrix representation of Graphs, Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest path algorithms.
Trees: Introduction to Trees, Properties of Trees, Spanning Trees, Depth-First Search, Breadth-First Search, Minimum Spanning Trees.

Total Periods: 45

EXPERIENTIAL LEARNING

The following is the sample. Faculty shall frame according to the course domain.

1. Let a > 1 be a positive integer. Pretend you want to divide n people into some number of teams, each of size a or a + 1. Show that this is possible provided n is larger than values in the Fibonacci polynomial $a2 - a - 1 = a(a-1) - 1$.
2. Identify the relations on the set of bits B = {0, 1} that are partial orders and those that are equivalence relations.
3. Pretend you are writing traffic accident software and want to categorize accidents by the day of the week on which they occur. Pretend there are n accident reports to categorize.
    (a) What is the size of the sample space? That is, in how many ways can the n accident reports be distributed over 7 days?
    (b) In how many ways can all n accidents occur on one single day?
    (c) In how many ways can all n accidents occur on only two days?
    (d) Let's looks at the other end: In how many ways can all n accidents occur on seven, and no less, days.

(It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXT BOOKS:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw Hill, 8th Edition, 2019.

2. Jon Pierre Fortney, Discrete Mathematics for Computer Science, CRC Press, Taylor & Francis Group, 1st Edition, 2021.

REFERENCE BOOKS:

1. Richard Johsonbaugh, "*Discrete Mathematics"* , Prentice Hall,8th Edition, 2019.

2. Narasing Deo, Graph Theory with application to Engineering and Computer Science, Prentice Hall India 2016.

3. J.P. Trembly and R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science,*Tata McGraw Hill, 37th Edition, 2017.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106106183
2. https://nptel.ac.in/courses/106106094
3. https://nptel.ac.in/courses/111107058

WEB RESOURCES:

1. https://www.coursera.org/learn/discrete-mathematics
2. https://people.cs.pitt.edu/~milos/courses/cs441/
3. https://web.stanford.edu/class/cs103x/cs103x-notes.pdf
4. https://edurev.in/studytube/Propositional-Logic-Discrete-Mathematical-Structur/8e588945-d315-41f0-a31e-0dc45829eb04_v

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22AI101002	**THEORY OF COMPUTATION**	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Finite automata; Nondeterministic Finite automata; Regular expressions; Applications of the pumping lemma; Context-Free Grammars; Normal forms for context-free grammars; pushdown automata; Chomsky hierarchy of languages; Turing machines.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Design finite state machines to recognize formal languages.
CO2. Analyze formal languages using automata.
CO3. Identify different types of grammars in formal languages.
CO4. Construct context free grammars for context free languages
CO5. Develop Turing machine for different computational problems.
CO6. Validate formal languages of automata by applying closure properties.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	-	-	-	-	-	-	-	-	3	-	-	-
CO2	2	3	2	-	-	-	-	-	-	-	-	-	3	-	-	-
CO3	3	3		-	-	-	-	-	-	-	-	-	3	-	-	-
CO4	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-	-
CO6	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: 3: High;   2: Medium;1: Low

COURSE CONTENT

Module 1:   FINITE AUTOMATA *(10Periods)*
Introduction to Finite automata, the central concepts of automata theory, Deterministic finite automata, Nondeterministic Finite automata, the equivalence of DFA and NDFA, Finite automata with epsilon-transitions, Conversion of epsilon-NFA to NFA and DFA, Mealy and Moore models.

Module 2:   REGULAR EXPRESSIONS AND LANGUAGES *(09Periods)*
Regular expressions, Identity rules, Finite automata and Regular expressions, Applications of regular expressions, Pumping lemma for regular languages, Applications of the pumping lemma, Closure properties of regular languages, Equivalence of two regular expressions, Equivalence of two finite automata and minimization of automata.

Module 3:   CONTEXT-FREE GRAMMARS *(09 Periods)*
Context-Free Grammars, Parse trees, Applications of context free grammars, Ambiguity in grammars and languages, Normal forms for context-free grammars, the pumping lemma for context-free languages.

Module 4: PUSH DOWN AUTOMATA *(08 Periods)*

Definition of the pushdown automaton, the languages of a PDA, Equivalence of PDA's and CFG's, Deterministic pushdown automata, Chomsky hierarchy of languages, Undecidability.

Module 5: TURING MACHINE *(09 Periods)*

Turing machine model, Representation of Turing machine, Language acceptability by Turing machine, Design of Turing machine, Techniques for Turing machine construction, Variants of Turing machines, Universal Turing machine, Recursive and recursively enumerable languages (REL), properties of recursive and recursively enumerable languages, the model of linear bounded automaton.

Total Periods: 45

EXPERIENTIAL LEARNING

1. State and prove pumping lemma theorem for regular language. Prove that a $L = \{a^n b^n$ for $n = 0,1,2,........\}$ Is not regular. b $L = \{a^{2n}/n \geq 1\}$ is regular.
2. Draw DFA for all strings over $\{0,1\}$ consisting of even number of 0's and 1's

(It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXT BOOKS:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D Ullman, Introduction to Automata Theory, Languages and Computation, Pearson Education, 3rd Edition, 2011.

REFERENCE BOOKS:

1. K.L.P. Mishra and N. Chandrasekaran, Theory of Computer Science: Automata Languages and Computation, PHI Learning, 3rd Edition, 2009.
2. John C Martin, Introduction to Languages and the Theory of Computation, TMH, 4 th Edition, 2010.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106104148
2. https://www.udemy.com/course/the-complete-theory-of-computation/

WEB RESOURCES:

1. Automata Tutorial | Theory of Computation - Javatpoint
2. Automata Tutorial - GeeksforGeeks
3. Automata Theory Tutorial (tutorialspoint.com)
4. theory-of-computation · GitHub Topics · GitHub

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22IT101001	**SOFTWARE ENGINEERING**	3	-	-	-	3

Pre-Requisite   - Object Oriented Programming through c++ / Java
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion onConcepts of Software Engineering, Software Process Models, Conventional and Agile Process Models, Software Requirements Engineering Process, System Analysis, Architectural Design, User Interface Design and Re-engineering, Software Testing, Risk and Quality Management.

COURSE OUTCOMES: *Aftersuccessful completion of the course, students will be able to:*
CO1. Demonstrate knowledge on Fundamental concepts of software engineering and analyze process models required to develop a software system.
CO2. Analyze software requirements and model requirements for the given scenario.
CO3. Apply design concepts and metrics for software development.
CO4. Apply testing strategies and techniques for quality software.
CO5. Analyze risks in software development life cycle and apply risk strategies to mitigate risks.
CO6. Work independently or in teams to develop and present software models with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-	3	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	-	3	-
CO3	3	3	3	2	2	-	-	-	-	-	-	-	3	-	3	-
CO4	3	3	3	2	2	-	-	-	-	-	-	-	2	-	3	-
CO5	3	2	2	2	2	-	-	-	-	-	-	-	2	-	3	-
CO6				2					3	3						
Course Correlation Mapping	3	3	3	2	2				3	3			3		3	

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT:

Module-1: SOFTWARE ENGINEERING AND SOFTWARE PROCESS   (11 periods)
A Generic view of process: The Nature of Software, Software Engineering- Software Engineering Layers; The Software Process, Software Engineering Practice, Software myths.
Process models: A Generic Process Model, Prescriptive Process Models-The Waterfall Model, Incremental Process Models, Specialized Process Models; The Unified Process, Agile Development-Agility, Agile Process, Extreme Programming (XP), Scrum, Lean Software Development (LSD), Dynamic System Development Method,Agile Modeling (AM), Agile Unified Process (AUP), The Cleanroom strategy.

Module-2: REQUIREMENTS ENGINEERING AND MODELING   (07 periods)
Requirements Engineering: Functional and non-functional requirements, The software requirements document, Requirements specifications, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.
Requirements Modeling: Requirements Analysis, Data Modeling Concepts, Flow-Oriented Modeling, Scenario based Modeling, UML Models that supplement the Use Case Case study on Requirements modeling for Web and MobileApps.

Module-3: DESIGN ENGINEERING AND METRICS   (08 periods)
Design Engineering: Design within the context of Software Engineering, The Design process, Design concepts, Software Architecture, Architectural Styles, Architectural design, Pattern based Design-Design Patterns, Pattern based software design.
Process and Project Metrics: Metrics in the process and project domains, Software Measurement, Metrics for software quality.

Module-4: SOFTWARE TESTING STRATEGIES AND APPLICATIONS (09 periods)
Testing strategies: A strategic approach to software testing, Strategic issues, Test strategies for conventional software, Test strategies for object oriented software, Validation testing, System testing, The art of debugging.
Testing Conventional Applications: Software testing fundamentals, White box testing-Basis path testing, Control structure testing; Black box testing, Object oriented testing methods.

Module-5: RISK, QUALITY MANAGEMENT AND REENGINEERING   (10 periods)
Risk and Quality Management: Reactive and Proactive risk strategies, Software risks, Risk Mitigation Monitoring and Management (RMMM), RMMM plan, Software quality factors, Defect Amplification Model, Formal Technical Reviews (FTR), Software Quality Assurance (SQA)-Tasks, Goals and Metrics; Software reliability.
Reengineering: Introduction, Business Process Reengineering (BPR), Software Reengineering, Restructuring, Reverse engineering, Forward engineering.
                                                          Total Periods: 45

EXPERIENTIAL LEARNING:

LIST OF CASE STUDIES:
Case studies given below should be Modeled using Visual Modeling tools in different views i.e. Use case view, logical view, component view, Deployment view.

CASE STUDY 1: ONLINE TICKET RESERVATION FOR RAILWAYS
Problem Statement: Computer play an integral part of the day in today's life. It makes the entire job easier and faster, every job is computerized so as the ticket reservation we can book over the online ticket reservation system. During the booking of the ticket reservation passenger has to select origin, date of journey, destination, class of train etc. The reservation counter keeps track of passenger's information. Thus the system will have all the details about the trains and facilities provided by them. There are various trains with the different level of convenience for the passengers. The whole database will be maintained by database administrator. There are varieties of trains where the passengers can select the train according to the convenience for their destination journey. The journey could be within the state or across the India. Each train has the three types of classes i.e. Sleeper class, First class and the AC compartment. Design the application for the above problem description.

CASE STUDY 2: A POINT OF SALE (POS) SYSTEM
Problem Statement: A POS System is a computerized application used to record sales and handle payments; it is typically used in a retail store. It includes hardware components such as a computer and bar code scanner, and software to run the system. It interfaces to various service applications, such as a third-party tax calculator and inventory control. These systems must be relatively fault tolerant; that

is, even if remote services and temporarily unavailable they must still be of capturing sales and handling at least cash payments. A POS system must support multiple and varied client – side terminals and interfaces such as browser, PDA's, touch – screens.

CASE STUDY 3: RECRUITMENT PROCEDURE FOR SOFTWARE INDUSTRY

Problem Statement: In the software industry the recruitment procedure is the basic thing that goes in the hand with the requirement as specified by the technical management team. HR first gives an advertisement in leading Newspapers, Journals, Weeklies and Websites. The job seekers can apply for it through by Post or by e-mail to the company.   The technical skill and the experience of the candidates are reviewed and the short listed candidates are called for the interview. There may be different rounds for interview like the written test, technical interview, and HR interview. After the successful completion of all rounds of interview, the selected candidates' names are displayed. Meanwhile HR gives all the details about the salary, working hours, terms and conditions and the retirement benefit to the candidate.

CASE STUDY 4: ONLINE AUCTION SALES

Problem Statement: The online auction system is a design about a website where sellers collect and prepare a list of items they want to sell and place it on the website for visualizing. To accomplish this purpose   the user has to access the site. Incase it's a new user he has to register. Purchaser's login and select items they want to buy and keep bidding for it. Interacting with the purchasers and sellers through messages does this. There is no need for customer to interact with the sellers because every time the purchasers bid, the details will be updated in the database. The purchaser making the highest bid for an item before the close of the auction is declared as the owner of the item. If the auctioneer or the purchaser doesn't want to bid for the product then there is fixed cutoff price mentioned for every product. He can pay that amount directly and own the product. The purchaser gets a confirmation of his purchase as an acknowledgement from the website. After the transition by going back to the main menu where he can view other items.

CASE STUDY 5: TWO FLOOR ELEVATOR SIMULATOR

Problem Statement: The elevator has the basic function that all elevator systems have, such as moving up and down, open and close doors, and of course, pick up passengers. The elevator is supposed to be used in a building having floors numbered from 1 to MaxFloor, where the first floor is the lobby. There are car call buttons in the car corresponding to each floor. For every floor except for the top floor and the lobby, there are two hall call buttons for the passengers to call for going up and down. There is only one down hall call button at the top floor and one up hall call button in the lobby. When the car stops at a floor, the doors are opened and the car lantern indicating the current direction the car is going is illuminated so that the passengers can get to know the current moving direction of the car. The car moves fast between floors, but it should be able to slow down early enough to stop at a desired floor. When an elevator has no requests, it remains at its current floor with its doors closed.
In order to certificate system safety, emergency brake will be triggered and the car will be forced to stop under any unsafe conditions.

CASE STUDY 6: HOME APPLIANCE CONTROL SYSTEM

Problem Statement: A home appliance control system (HACS) is a system which provides various services to remotely operate on home appliances, such as microwave oven, TV, and garage door etc through remote devices such as mobile phone, desktop and palm-top.A home appliance control system (HACS) is a system which is controlled by a remote system such as a mobile phone or a palm-top, and at the same time controls, monitors and coordinates home appliances such as air conditioner, microwave oven, garage doors, TV set, VCR, audio controller, indoor/outdoor lights, water sprinkler, home security system, bath tub controller, etc. In order to activate home appliances and to allow for different ways of cooking, the HACS needs mechanisms for communication between the different devices in the system, and for coordination among the various processes running on such devices. The system administrator of the HACS system has the ability to add a new appliance or delete an

existing one. The system administrator has the ability to add a new remote device and configure it with HACS or delete an existing one when it is not used. Also the system administrator can create an account for a new user or delete existing account if it is no longer used.

1. Identify Functional and Non Functional Requirements for
i) Online Ticket Reservation for Railways, ii) Online Auction Sales
2. Prepare the Software Requirement Specification (SRS), High Level Design (HLD) and Detailed Design (DD) for the following experiments
1. Employee Information System, ii) Online Airline Reservation

Note: For the reference of SRS, HLD and DD templates refer department manual and use any open source Requirement documentation tool. Estimate project parameters such as size, effort and time for development for a Library Information system using Basic COCOMO model.

Mini project: For any given problem identify functional and non- functional requirements, prepare SRS document and design the system using UML diagrams.

RESOURCES
TEXT BOOKS:
1. Roger S. Pressman, *Software Engineering - A Practitioner's Approach,* McGraw-Hill, Eight Edition, 2015.
2. Ian Sommerville, *Software Engineering***,** Pearson Education, Ninth Edition, 2011.

REFERENCE BOOKS:
1. K. K. Aggarwal and Yogesh Singh, *Software Engineering,* New Age International Publishers, Third Edition, 2007.
2. Shely Cashman Rosenblatt, *Systems Analysis and Design*, Thomson Publications, Sixth Edition, 2006.

REFERENCE BOOKS:
1. Grady Booch, James Rum Baugh and Ivar Jacobson, *The Unified Modeling Language User Guide*, Pearson Education, Second Edition, 2009.
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons and David Fado, *UML 2 Toolkit*, WILEY-Dreamtech India Pvt. Ltd., 2003.
3. Rajesh Naik and Swapna Kishore, *Software Requirements and Estimation*, Tata McGraw Hill, New Delhi, 2001.

SOFTWARE/TOOLS USED:
- Visual Paradigm for modeling diagrams

VIDEO LECTURES:
- https://nptel.ac.in/courses/106105087/
- https://nptel.ac.in/courses/106105182/

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CS101001	**DIGITAL LOGIC DESIGN**	3	-	-	-	3

Pre-Requisite -
Anti-Requisite Switching Theory and Logic Design
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Foundations in the operation of digital gates, Concepts of Boolean algebra, Minimization of logic circuits, Design and implementation of combinational and sequential logic circuits, Design digital systems using Programmable logic.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Apply knowledge of binary systems, logic gates and Boolean functions to represent a given problem using Boolean logic.
CO2. Minimize and implement Boolean functions to build combinational logic circuits.
CO3. Design combinational and sequential logic circuits for digital systems.
CO4. Design digital systems using programmable logic to solve engineering problems.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: BINARY SYSTEMS AND BOOLEAN ALGEBRA *(10 Periods)*
Introduction, Binary Numbers, Number Base Conversions, Error Detection and Correction, Complements of Numbers, Signed Binary Numbers, Binary Codes, Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates.

Module 2: GATE LEVEL MINIMIZATION *(09 Periods)*
The Map Method, Four Variable K-Map, Product-of-Sums and Sum-of-Products Simplification, Don't Care Conditions, NAND and NOR Implementations, Other Two Level Implementations, Exclusive–OR function.

Module 3: COMBINATIONAL LOGIC *(09 Periods)*
Combinational Circuits, Analysis of Combinational Circuits, Design Procedure, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, De-Multiplexers.

Module 4: SEQUENTIAL LOGIC *(10 Periods)*
Latches, Flip-Flops, Analysis of Clocked Sequential Circuits, Design of Synchronous Sequential Circuits, Registers, Shift Registers, Ripple Counters, Synchronous Counters, Ring Counter and Johnson Counter.

Module 5: PROGRAMMABLE LOGIC *(07 Periods)*
RAM, ROM, Programmable Logic Array, Programmable Array Logic, Sequential Programmable Devices.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Design the digital circuit system of the vehicle with two photocell sensors, which work as inputs. Simulate the virtual circuit using NI Multisim software considering the following specifications:

   a) Each side (right of left) of that sensor circuit which communicate with each motor to output the signals so the vehicle can correct the direction along the track and drive. The track is outlined by two LED strip lights, as an input source, on both ends adhered on the ground about one feet apart. For instance, when the vehicle is close to the LED strip lights on the right-side track, the right side of the photocell sensor detects the bright lights, and it sends a positive signal to the left motor. That is, the input of the left photocell logic is 0 (off) because the left sensor does not detect the light and the right photocell logic is 1 (on). The output of the left and right motors in this case are represented as logics 1 and 0 respectively, which makes only the left motor spins to steer to the left side moving away from the right side of LED strip.

   b) Once the vehicle moves off the light, the both sides of the motors will operate and the vehicle would move straight forward until it encounters another LED strip light. In the case of the left side, the opposite would happen. The left sensor detects the LED strip light on the left side track. Thus, only the right motor will run to make the vehicle to steer to the right side.

   c) Since two LED strips are far (about 30 cm) apart, both the left and right photocell will not detect the light at the same time. However, it can be defined as negative output for both motors to follow the logics and therefore the vehicle will stop moving.

RESOURCES

TEXT BOOKS:

1. M. Morris Mano, Michael D. Ciletti, Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th edition, Pearson, 2018.

REFERENCE BOOKS:

1. A. Anand Kumar, Switching Theory and Logic Design, 3rd edition, PHI Learning Private Limited, India, 2016.
2. Charles H. Roth, Jr. and Larry L. Kinney, Fundamentals of Logic Design, 7th edition, Cengage Learning, 2015.
3. Alan B. Marcovitz, Introduction to Logic Design, 3rd edition, McGraw Hill, 2010.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/108106177
2. https://nptel.ac.in/courses/106105185
3. https://www.youtube.com/watch?v=RZo--xYfTR4
4. https://www.youtube.com/watch?v=3vEV55D103g
5. https://www.youtube.com/watch?v=axGvxdUpEIE
6. https://www.youtube.com/watch?v=QEFW4DcyOC0
7. https://www.youtube.com/watch?v=wIeqYG4c6Ho

WEB RESOURCES:

1. https://www.rapidtables.com/convert/number/base-converter.html
2. https://learnabout-electronics.org/Digital/dig10.php
3. https://www.tutorialspoint.com/computer_logical_organization/digital_counters.htm
4. https://www.electronics-tutorial.net/programmable-logic-devices/complex-programmable-logic-device/
5. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/comp_networks_sm/labs/exp1/procedure.php
6. https://unacademy.com/course/logic-gates-and-boolean-algebra-iit-jee/GUT1BCXY
7. https://byjus.com/jee/basic-logic-gates/
8. https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/reader/ch1to12.pdf

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CS101002	**COMPUTER ORGANIZATION AND ARCHITECTURE**	3	-	-	-	3
Pre-Requisite	Digital Logic Design					
Anti-Requisite	-					
Co-Requise	-					

COURSE DESCRIPTION: This course deals with basic function, structure and components of computer system, Central Processing Unit, Control Unit and I/O Unit. This course also imparts knowledge on different types of Memory Systems, Parallel Processing techniques and Multicore architectures with its issues.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Demonstrate knowledge on computer organization, architecture and interconnection structures of a digital computer.
CO2. Analyze Arithmetic Operations, Addressing Modes, Instruction Formats, Processor and Register organization.
CO3. Design digital circuits for the given functional description of microoperations and memory elements.
CO4. Investigate the performance of Input /Output Systems, Memory systems, parallel processors, Multicore architectures to evaluate the cost-performance trade-offs.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2		-	-	-	-	-	-	-	-	-	3	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	-	-	-

Correlation Levels: 1: Low   2: Medium: 3: High

COURSE CONTENT

Module 1:   INTRODUCTION TO COMPUTER SYSTEM   (08 Periods)

Organization and architecture, Structure and function, IAS computer structure, Computer function, Interconnection structures, Bus interconnection.

Module 2:   CENTRAL PROCESSING UNIT   (09 Periods)

Arithmetic logic unit, Integer multiplication- Booth's algorithm; Floating point representation principles, Machine instruction characteristics, Addressing modes, Instruction formats – Instruction length, Allocation of bits; Processor organization, Register organization – User visible registers, Control and status registers; Instruction cycle.

Module 3:   CONTROL UNIT AND INPUT/OUTPUT   (10 Periods)

Control Unit: Micro operations, Control of the processor – Functional requirements, Control signals, Internal processor organization; Hardwired implementation, Microinstructions, Micro programmed control unit, Micro instruction sequencing – Design considerations, sequencing techniques, Address generation; Micro instruction execution- A taxonomy of microinstructions, Microinstruction encoding.
Input/Output: External devices, I/O modules, Direct memory access function, I/O Channels and Processors, PCI Physical and Logical Architecture.

Module 4:   MEMORY SYSTEMS   (09 Periods)

Semiconductor Memories: Computer Memory System overview, Semiconductor Main Memory- Organization, DRAM and SRAM, Types of ROM, Chip logic, Chip packaging, Module organization, Interleaved memory; DDR DRAM, Flash Memory, Newer Nonvolatile Solid-State Memory Technologies.
Cache Memory: Cache Memory Principles, Elements of Cache Design-Cache Addresses, Mapping Functions.
External Memory: Solid State Drives.

Module 5:   PARALLEL ORGANIZATION   (09 Periods)

Parallel Processing: Multiple Processor Organizations, Instruction Pipelining, Symmetric Multiprocessors, Non uniform Memory Access, Multicore Organization.
Multicore Computers: Hardware performance issues, Software performance issues, Multicore organization, Intel Core i7-990X.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Write a report on Product Specifications such as CPU, Memory, Processor Graphics and advanced technologies of Intel Core i9-12900K -New performance hybrid architecture. The World's Best Gaming Processor: Available with up to 16 cores and 24 threads, the new 12th Gen Intel Core processor family includes the world's best gaming processor, the Core i9-12900K, unleashing gaming experiences across top titles.
    (https://ark.intel.com/content/www/us/en/ark/products/134599/intel-core-i912900k-processor-30m-cache-up-to-5-20-ghz.html)

2. Write a report on OpenCL(Open Computing Language) framework used for writing programs that execute across heterogeneous platforms consisting of central processing units, graphics processing units, digital signal processors, field-programmable gate arrays and other processors or hardware accelerators.(https://www.khronos.org/api/opencl)

RESOURCES

TEXT BOOKS:

1. William Stallings, Computer Organization and Architecture: Design for performance, Pearson, 11th Edition, 2020.

REFERENCE BOOKS:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, McGraw Hill Education, 2013.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design - A Hardware software interface, 5th Edition, Morgan Kaufmann, 2014.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_cs37/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs64/preview
3. https://onlinecourses.nptel.ac.in/noc21_cs47/preview
4. https://freevideolectures.com/course/2277/computer-organization
5. https://www.youtube.com/watch?v=4TzMyXmzL8M

WEB RESOURCES:

1. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
2. https://www.geeksforgeeks.org/last-minute-notes-computer-organization/
3. https://gateoverflow.in/blog/9728/some-good-resources-for-computer-organisation-architecture
4. https://tutorialspoint.dev/computer-science/computer-organization-and-architecture/

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22AI102001	**OPERATING SYSTEMS**	3	-	2	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Operating Systems Operations; Process Scheduling; Process Synchronization, Deadlocks; Paging and Segmentation, Disk Scheduling; File Concepts, I/O Interface; Concepts of Protection and Security.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze performance of CPU scheduling algorithms.

CO2. Design solutions for process synchronization problems by using semaphores and monitors.

CO3. Devise solutions for deadlocks using deadlock handling mechanisms.

CO4. Solve memory management problems using page replacement and disk scheduling algorithms.

CO5. Identify efficient file allocation methods for optimal disk utilization & analyse services of I/O subsystems and mechanisms of security & protection.

CO6. Work independently or in team to solve problems with effective communication

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	2	-	-	-	-	-	-	-	3	-	-	2
CO2	2	2	3	-	2	-	-	-	-	-	-	-	3	-	-	2
CO3	2	2	3	-	2	-	-	-	-	-	-	-	3	-	-	2
CO4	2	2	3	-	2	-	-	-	-	-	-	-	-	-	3	2
CO5	3	3	-	3	-	-	-	-	-	-	-	-	3	-	-	2
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Course Correlation Mapping	**2**	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**-**	**3**	**2**

Correlation Levels: 3: High;   2: Medium;1: Low

COURSE CONTENT

**Module 1   INTRODUCTION TO OPERATING SYSTEM AND   *(08 Periods)*
PROCESS MANAGEMENT**

Introduction: Definition, Operating System Structure and Services, System Calls.
Process Management: Process Scheduling, Process Control Block, Inter Process Communication, Threads, Multithreading Models, CPU Scheduling Criteria, Scheduling Algorithms, Multiprocessor Scheduling.

Module 2   PROCESS SYNCHRONIZATION AND DEADLOCKS   *(10 Periods)*

Process Synchronization: Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Synchronization Problems, Monitors.
Deadlocks: System Model, Deadlock characterization, Methods for handling deadlocks, Prevention, Detection, Avoidance, Recovery from deadlock.

Module 3   MEMORY MANAGEMENT AND SECONDARY STORAGE   *(10 Periods)*

Memory Management: Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging.
Virtual Memory: Demand Paging, Page Replacement Algorithms, Copy-on-Write, Thrashing.
Secondary Storage Structure: Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management.

Module 4   FILE AND I/O SYSTEMS   *(08 Periods)*

File System: File concept, Access Methods, Directory Structure, File System Structure, i-node, File System Implementation, Directory Implementation, Allocation Methods.
I/O System: I/O Hardware, Application I/O Interface, Kernel I/O subsystem.

Module 5   PROTECTION AND SECURITY   *(09 Periods)*

Protection: Goals, Principles, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights.
Security: Security Problem, Program Threats, System and Network Threats, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks, Computer-Security Classifications.

Total Periods: 45

EXPERIENTIAL LEARNING

1.   a) Write a program to implement Process System Calls.

   b) Write a program to implement I/O System Calls.

2.   Write a program to implement named and unnamed pipes.

3.   Demonstrate File Permissions.

4.   Analyze the following CPU Scheduling Algorithms:

   a) FCFS b) SJF (Preemptive) c) Priority d) Round Robin

5.   Design solutions for the following synchronization problems:

   a) Producer Consumer Problem b) Dining Philosophers Problem.

6.   Design Banker's Algorithm for Deadlock Avoidance. Find the safe sequence. If Maximum request of any one process is changed, detect whether a deadlock has occurred or not.

Consider the number of resources are three and Jobs are five.

7. Implement the following Algorithms:

    a) First Fit   b) Best Fit   c) Worst Fit

8. Implement the following Page Replacement Algorithms

    a) FIFO   b) LFU   c) LRU   d) Optimal

9. Implement the following Disk Scheduling Algorithms

    a) FCFS   b) SSTF   c) SCAN   d) CSCAN

10. Implement the following file allocation strategies:

    a) Contiguous Allocation   b) Linked Allocation

RESOURCES

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, Wiley India Edition, 9th Edition, 2016.

REFERENCE BOOKS:

1. William Stallings, Operating Systems, Internals and Design Principles, Pearson Education, 7th Edition, 2013.
2. Andrew S. Tanenbaum, Modern Operating Systems, PHI, 3rd Edition, 2009.

SOFTWARE/TOOLS:

1. **Software: Windows, Linux OS, Fedora OS, Ubuntu OS**

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_cs72/preview
2. https://www.udemy.com/course/operating-systems-from-scratch-part1/

WEB RESOURCES:

1. operating-systems · GitHub Topics · GitHub
2. Operating System Introduction (w3schools.in)
3. What is Operating System (OS)? Defintion and Functions - javatpoint
4. Operating System Tutorial - GeeksforGeeks

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CB102001	**CRYPTOGRAPHY AND NETWORK SECURITY**	3	-	2	-	4

Pre-Requisite COMPUTER NETWORKS
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Concepts of cryptographic algorithms, Substitution techniques, Symmetric ciphers, Block cipher operations, Cryptographic data integrity algorithms, Key management and distribution, User authentication, Transport level security, Electronic mail security, IP security.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Apply the knowledge of network security concepts, symmetric and public key cryptosystems for securing information.
CO2. Apply hash functions, message authentication codes and digital signatures for providing data integrity in information security applications.
CO3. Use key management and distribution techniques, user authentication techniques for assuring mutual trust among users.
CO4. Demonstrate knowledge on network and Internet security techniques for addressing the security threats.
CO5. Work independently and in teams to solve security problems with effective communication

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	-	-	3	-	-	-	-	3	3	3	2
CO2	3	3	-	3	-	-	-	-	-	-	-	-	3	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	3	3	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	3	3	2
CO5	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Course Correlation Mapping	3	3	-	3	-	-	-	3	3	3	-	-	3	3	3	2

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT
Module 1:   INTRODUCTION   *(09 Periods)*

Computer security concepts, Security attacks, Security services, Security mechanisms, Model for network security, Symmetric cipher model, Substitution techniques - Monoalphabetic ciphers and Polyalphabetic ciphers.

Module 2:   SYMMETRIC CIPHERS   *(07 Periods)*
Stream ciphers and block ciphers, Data Encryption Standard (DES), Advanced Encryption Standard (AES) - Structure, Transformation Functions; Block Cipher Operation - Multiple encryption and triple DES, Cipher block chaining mode, Cipher feedback mode, Output feedback mode, Counter mode.

Module 3:   PUBLIC KEY CRYPTOGRAPHY AND CRYPTOGRAPHIC   *(09 Periods)*
                 DATA INTEGRITY ALGORITHMS
Public Key Cryptography: RSA, Diffie-Hellman key exchange, Elgamal cryptographic system.

Cryptographic Data Integrity Algorithms: Hash Functions - Simple hash functions, Secure Hash Algorithm SHA-512; Message Authentication Codes – Requirements, Functions, Security of MACs, HMAC; Digital signatures - Schnorr Digital signature scheme;

Module 4:   MUTUAL TRUST   *(10 Periods)*

Key Management and Distribution: Symmetric key distribution using symmetric and asymmetric encryption, Distribution of public keys, X.509 certificates, Public key infrastructure.
User Authentication: Remote user authentication principles, Kerberos, Personal identity verification.

Module 5:   NETWORK AND INTERNET SECURITY   *(10 Periods)*

Transport Level Security: Web security considerations, Transport layer security, HTTPS.
Electronic Mail Security: S/MIME, Pretty Good Privacy, DNSSEC.
IP Security: Overview, Policy, Encapsulating security payload.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Construct a Caesar cipher and convert the word "the Network security" into Cipher text with k=3.
2. Generate the Cipher text for the message "BALLOON" using play fair Cipher.

3. Generate the cipher text for the message "me" and also regenerate the message from the cipher text using hill cipher and with the key

$$\begin{pmatrix} 9 & 4 \\ 5 & 7 \end{pmatrix}$$

4. Construct a cipher for the word "the Network security" using rail fence of Depth = 2.
5. Perform the Simple DES on the following data and calculate the cipher text for the plain text "10100101" and the key is "0010010111"

P10:	3	5	2	7	4	10	1	9	8	6
P8:	6	3	7	4	8	5	10	9		
E/P:	4	1	2	3	2	3	4	1		
S0		0	1	2	3					
	0	1	0	3	2					
	1	3	2	1	0					
	2	0	2	1	3					
	3	3	1	3	2					
S1		0	1	2	3					
	0	0	1	2	3					
	1	2	0	1	3					
	2	3	0	1	0					
	3	2	1	0	3					
P4:	2	4	3	1						
IP:	2	6	3	1	4	8	5	7		
IP^{-1}:	4	1	3	5	7	2	8	6		

6. Using Fermat's theorem, find 4^{225} mod 13.
7. Consider a one-way authentication technique based on asymmetric encryption:
   A -> B: ID_A
   B -> A: R_1
   A ->B: $E(PR_a, R_1)$
   a. Explain the protocol.
   b. What type of attack is this protocol susceptible to?
8. Consider a one-way authentication technique based on asymmetric encryption:
   A -> B: $IDA \,||\, E(PU_B, R_A)$
   B -> A: R_A
   a. Explain the protocol.
   b. What type of attack is this protocol susceptible to?

9. Investigate the network access control scheme used at your College. Draw a diagram and describe the principal components.
10 List some commonly used cloud-based data services. Explore and compare these services based on their use of encryption, flexibility, efficiency, speed, and ease of use. Study security breaches on these services in recent past. What changes were made by the services after these attacks?

RESOURCES

TEXT BOOKS:
1. William Stallings, *Cryptography and Network Security: Principles and Practice*, 8th Edition, Pearson, 2020

REFERENCE BOOKS:
1. William Stallings, *Network Security Essentials: Applications and Standards*, 6th Edition, Pearson, 2018.
2. Douglas R. Stinson, Maura B. Paterson, *Cryptography: Theory and Practice*, 4th Edition, CRC Press, 2018.
3. Atul Kahate, Cryptography and Network Security, 3rd Edition, McGraw Hill, 2017.

VIDEO LECTURES:
1. https://www.youtube.com/watch?v=JoeiLuFNBc4&list=PLBlnK6fEyqRgJU3EsOYDTW7 m6SUmW6kII&index=1
2. https://www.coursera.org/learn/crypto#syllabus
3. https://nptel.ac.in/courses/106105031

WEB RESOURCES:
1. https://www.javatpoint.com/computer-network-security
2. https://www.tutorialspoint.com/cryptography/index.htm
3. https://www.geeksforgeeks.org/cryptography-introduction/

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CB101001	**CYBER SECURITY ESSENTIALS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Cyber Security Fundamentals, Cyber Security Fundamentals, Attacker techniques and motivations, Fraud techniques, Threat infrastructure, Exploitation, Malicious code, Defense and analysis techniques, Intrusion detection techniques

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understanding the fundamental concepts of cyber security concepts

CO2. Identify the pattern of launching attacker and fraud techniques to reduce risk and impact of cyber-attacks.

CO3. Identify the vulnerabilities using the SQL injection and web exploitation techniques in a system for securing data.

CO4. Apply code obfuscation techniques to prevent any unauthorized party from accessing logic of an application

CO5. Apply honey pots and malicious code-naming techniques to defend against attacks in memory.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	3	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	3	3	-
CO5	3	2	3	2	-	-	-	-	-	-	-	-	3	3	3	-
Level of correlation of the course	3	3	3	2	-	-	-	-	-	-	-	-	3	3	3	2

Correlation Levels: 3: High;   2: Medium;1: Low

COURSE CONTENT:

Module 1:   CYBER SECURITY FUNDAMENTALS   *(10 Periods)*

Network Security Concepts: Information assurance fundamentals, Basic cryptography, Symmetric encryption, Public key encryption, The Domain Name System(DNS), Firewalls, Virtualization, Radio-Frequency Identification.

Module 2:   ATTACER TECHNIQUES   *(09 Periods)*

Attacker techniques and motivations: Anti forensics, proxy usage, Tunneling techniques: HTTP, DNS, ICMP, Intermediaries, Steganography and other concepts, Detection and prevention.

Fraud techniques: Phishing, smishing, vishing and mobile malicious code, rogue antivirus, click fraud.

Threat infrastructure: Botnets, Fast Flux, Advanced Fast Flux.

Module 3:   EXPLOITATION   *(09 Periods)*

Shellcode, Integer overflow vulnerabilities, Stack based buffer overflows, Format string vulnerabilities, SQL injection, Malicious PDF files, Race conditions, Web exploit tools, DoS conditions, Brute force and dictionary attacks.

Module 4:   MALICOUS CODE   *(10 Periods)*

Worms, viruses, Evading detection and elevating privileges: obfuscation, Virtual Machine obfuscation Persistent software techniques,Token kidnapping, Virtual machine Detection, Rootkits, Spyware, Attacks against privileged user accounts and escalation of privileges, Stealing information and Exploitation.

Module 5:   DEFENSE AND ANALYSIS TECHNIQUES   *(07 Periods)*

Importance of memory forensics, Capabilities of memory forensics, Memory analysis frameworks, Dumping physical memory, Installing and using volatility, Finding hidden processes, Volatality analyst pack.

Honeypots, Malicious code naming, Automated malicious code analysis systems, Intrusion detection techniques.

Total Periods: 45

EXPERIENTIAL LEARNING:

Network Security Basics:

Configuring firewalls: Set up and configure firewall rules to control incoming and outgoing network traffic.
Intrusion detection/prevention systems (IDS/IPS): Deploy and manage IDS/IPS solutions to detect and mitigate network threats.

Virtual private networks (VPNs): Configure VPN connections to secure remote access and data transmission over public networks.
Operating System Security:

Hardening operating systems: Implement security best practices and configurations to strengthen the security posture of operating systems.
Patch management: Develop and execute patch management strategies to keep systems up to date with security patches and updates.
User access controls: Configure user permissions, access levels, and authentication mechanisms to prevent unauthorized access.

RESOURCES

TEXT BOOKS:

1. James Graham, Richard Howard, Ryan Olson," Cyber Security Essentials", CRC Press, 2011.(Rs.6900)
2. Chwan-Hwa(john) Wu,J. David Irwin, "Introduction to Cyber Security", CRC Press T&F Group.

REFERENCE BOOKS:

1. Nina Godbole and SunitBelpure, "Cyber Security Understanding Cyber Crimes,Computer Forensics and Legal Perspectives" , Wiley publications.

2. B.B.Gupta, D.P.Agrawal, HaoxiangWang, "Computer and Cyber Security: Principle s, Algorithm, Applications, and Perspectives", CRC Press, ISBN 9780815371335, 2018.

VIDEO LECTURES:

1. https://www.coursera.org/learn/introduction-to-cybersecurity-essentials

2. https://www.udemy.com/course/cybersecurity-essentials/

WEB RESOURCES:

1. https://github.com/topics/cybersecurity

2. https://www.youtube.com/watch?v=nzZkKoREEGo

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CB102002	**COMPUTER NETWORKS**	3	-	2	-	4

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion onIntroduction to computer networks; Protocols of physical layer, data link layer, medium access control sub layer, network layer, transport layer, application layer.

COURSE OUTCOMES: *After successful completion of this course, the students will be able to:*

CO1.   Analyze the types of network topologies, layers and protocols.

CO2.   Evaluate sub netting and routing algorithms for finding optimal paths in networks.

CO3.   Solve problems related to flow control, error control and congestion control in data transmission.

CO4.   Assess the impact of wired and wireless networks in the context of network protocols Like DNS, SMTP, HTTP, and FTP.

CO5.   Apply ethical principles and standards for developing network-based solutions.

CO6.   Work independently and in teams to solve network related problems with   effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	3	-	-	-	-	-	-	-	3	3	3	2
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	3	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3	2
CO4	3	2	2	2	2	-	-	-	-	-	-	-	3	3	3	2
CO5	3	2	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Course Correlation Mapping	3	3	-	3	-	-	-	-	3	3	-	-	3	3	3	2

Correlation Levels: *3: High;*   *2: Medium; 1: Low*

COURSE CONTENT:

MODULE 1: INTRODUCTION AND PHYSICAL LAYER   (9 Periods)

Network hardware, Network software, Reference models - OSI, TCP/IP; Example networks – Internet; Wireless LANs - 802.11.

Physical Layer - Guided transmission media, Wireless transmission, Switching - Circuit switching, Packet switching.

MODULE 2: DATA LINK LAYER AND MEDIUM ACCESS CONTROL SUBLAYER(9 Periods)

Data Link Layer: Data link layer design issues, Error detection and correction - CRC, Hamming codes; Elementary data link protocols, Sliding window protocols.

Medium Access Control Sub layer: ALOHA, Carrier sense multiple access protocols, Collision free protocols, Ethernet, Data link layer switching - Repeaters, Hubs, Bridges, Switches, Routers, Gateways.

MODULE 3: NETWORK LAYER   (9 Periods)

Network layer design issues, Routing algorithms - Shortest path algorithm, Flooding, Distance vector routing, Link state routing, Hierarchical routing, Broadcast routing, Multicast routing, Any cast routing; Congestion control algorithms, Network layer in the internet - The IP version 4 protocol, IP addresses, IP version 6, Internet control protocols, OSPF, BGP.

MODULE 4: TRANSPORT LAYER   (9 Periods)

UDP – Segment header, Remote procedure call, Real-time transport protocols; TCP – service model, Protocol, Segment header, Connection establishment, Connection release, Sliding window, Timer management, Congestion control.

MODULE 5: APPLICATION LAYER   (9 Periods)

Domain Name System (DNS) - Name space, Domain resource records, Name servers; Electronic mail - Architecture and services, User agent, Message formats, Message transfer, Final delivery; The World Wide Web - Architectural overview, HTTP, FTP.

Total Periods: 45

EXPERIENTIAL LEARNING:

LIST OF EXERCISES:

1.   Implement the following data link layer framing methods.
       i) Character count
       ii) Character stuffing
       iii) Bit stuffing

2.   Implement the frame sorting technique used in buffers.

3. Design and develop a program to compute checksum for the given frame 1101011011 using CRC-12, CRC-16, and CRC-CCIP. Display the actual bit string transmitted. Suppose any bit is inverted during transmission. Show that this error is detected at the receiver's end.

4. Implement Dijkstra's algorithm to compute the shortest path for the given graph.
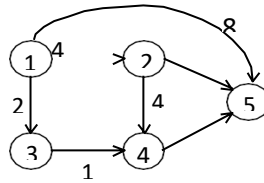
5. Develop a program to obtain routing table for each node using Distance Vector Routing Algorithm by considering the given subnet with weights indicating delay between Nodes.
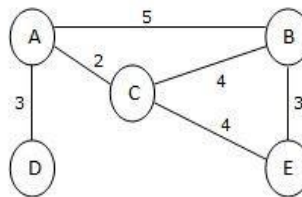
6. Write a program to simulate flow-based routing.

7. Write a program to simulate random early detection congestion control algorithm.

8. Using TCP/IP sockets, write a client-server program to open a file available in the server.

9. Write a program for congestion control using leaky bucket algorithm.

10. Write a program for the Mail Client
    i) POP Client: Gives the server name, user name and password retrieve the mails and allow manipulation of mail box using POP commands.
    ii) SMTP Client: Gives the server name, send email to the recipient using SMTP commands.

11. Write a program for HTTP server to implement the commands - GET, POST, HEAD and DELETE. The server must handle multiple clients.

Exercises on Packet Tracer Simulator Tool:

12. a) Study of basic network commands and network configuration commands.
       i) ping   ii) nslookup   iii) netstat   iv) ifconfig

    b) Create a network topology and configure a networktopology with four PCs, two switches, and two routers.

REFERENCE BOOKS:
1. Andrew S. Tanenbaum and David J. Wetherall, *Computer Networks*, Pearson, 5th Edition, 2015.
2. A. Jesin, *Packet Tracer Network Simulator*, Packt Publishing, 2014.

Software/Tools used:
1. C/Python/Java
2. Network simulator tool - Packet Tracer
3. Virtual Labs (Computer Networks Lab – http://vlabs.iitb.ac.in/vlabs-dev/labs_local/ computer-networks/ labs/explist.php)

ADDITIONAL LEARNING RESOURCES:
1. https://www.itprc.com/packet-tracers/
2. https://www.nsnam.org/docs/tutorial/html/
3. http://www.tcpipguide.com/free/t_OSIReferenceModelLayers.htm

VIDEO LECTURES:
1. https://onlinecourses.nptel.ac.in/noc21_cs18/preview
2. https://www.coursera.org/learn/tcpip

WEB RESOURCES:
- https://www.cisco.com/c/en/us/solutions/small-business/resourcecenter/networking/networking-basics.html
- https://memberfiles.freewebs.com/00/88/103568800/documents/Data.And.Computer.Communications.8e.WilliamStallings.pdf

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CB102003	**SECURITY THREATS AND MODELING**	3	-	2	-	4

Pre-Requisite   Cryptography and Network Security

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION:

COURSE OUTCOMES: *After successful completion of the course, students will be able to*:

CO1. Demonstrate knowledge on threat modeling strategies.

CO2. Apply security tools for finding attacks.

CO3. Apply Defensive Tactics and Technologies to mitigate the threats.

CO4. Model Web and Cloud Threats using threat modeling tools.

CO5. Apply threat modeling tools to real-time cryptosystems.

CO6. Work independently and in teams to solve network security issues with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	3	3	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	3	3	-
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3	-
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3	-
CO5	3	3	2	2	2	-	-	-	-		-	-	3	3	3	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**

Correlation Levels: *3: High;*   *2: Medium; 1: Low*

COURSE CONTENT

Module 1:   INTRODUCTION   *(09 Periods)*
Dive In and Threat Model: Learning to Threat Model.
Strategies for Threat Modeling: Examples of Threats, Structured Approaches to Threat Modeling, Models of Software.
Module 2:   FINDING THREATS   *(09 Periods)*
Stride: Spoofing Threats, Tampering Threats, Repudiation Threats, Information Disclosure Threats, Denial-of-Service Threats.
Attack Trees: Working with Attack Trees, Representing a Tree, Real Attack Trees.
Attack Libraries: Properties of Attack Libraries.

Module 3:   MANAGING AND ADDRESSING THREATS   *(8 Periods)*
Processing and Managing Threats: Starting the Threat Modeling Project, Digging Deeper into Mitigations, Tracking with Tables and Lists, Scenario-Specific Elements of

Threat Modeling.
Defensive Tactics and Technologies: Tactics and Technologies for Mitigating Threats, Addressing Threats with Patterns, Mitigating Privacy Threats.
Module 4:   MODELING TOOLS   *(11 Periods)*

Threat modeling tools: Generally Useful Tools, Open-Source Tools, Commercial Tools.
Web and Cloud Threats: Web Threats, Cloud Tenant Threats, Cloud Provider Threats, Mobile Threats.
Module 5:   THREAT MODELING IN TECHNOLOGIES AND   *(8 Periods)*
                TRICKY AREAS
Threats to Cryptosystems: Cryptographic Primitives, Classic Threat Actors, Attacks against Cryptosystems, Building with Crypto, Things to Remember about Crypto.
Experimental Approaches: Looking in the Seams, Operational Threat Models, Threats to Threat Modeling Approaches and Implementation.
                                                              Total Periods: 45

EXPERIENTIAL LEARNING

1. Create an attack tree for learning someone's online banking account username and password.
2. Perform the following using Microsoft Threat Modeling Tool 2016
a. Create a new threat model.
b. Modify the existing threat model.
c. Upgrading a threat model to use a new template.
d. Demonstrate to file bugs on Threat Modeling Tool security issues.

3. Create custom templates for threat modeling.
4. Extend the Threat template to create Stencils.
5. a. Create different threat types.
b. Add threat properties.
c. Update threat models.
6. Use Scapy to
a. Sniff and Spoof Packets
b. Spoofing ICMP Packets.
7. Apply Microsoft Threat Modeling Tool to STRIDE-based software-centric approach for threat identification tool for Temperature Management System.
8. Demonstrate mitigation of threats using Microsoft Defender for Cloud.

TEXT BOOKS:
1. Adam Shostack, "Threat Modeling: Designing for Security" Wiley publication, Edition, 20014.
2. Frank Swiderski, Window Snyder "Threat Modeling (Microsoft Professional)" Microsoft Press, Edition, 2008.

REFERENCE BOOKS:
1. Ferguson, Schneier and Kohno, Cryptography Engineering: Design Principles and Practical, Wiley, 2nd edition, 2015.
2. Microsoft Threat Modeling Tool, 2016 User guide.
3. Wenliang Du ,SEED Book, Computer & Internet Security: A Hands-on Approach, 2nd Edition
4. Wenliang Du, Internet Security: A Hands-on Approach,

SOFTWARE/TOOLS:
- Gitlab
- **Microsoft Threat Modeling Tool**
- Microsoft Defender for Cloud
- SEEDUbuntu 20.04 VM
- Python 3.8

- Python Libraries – NumPy, Pandas, Matplotlib, Seaborn, Beautiful Soup, Vader

VIDEO LECTURES:

1. https://www.handsonsecurity.net.
2. https://www.handsonsecurity.net/video.html.

WEB RESOURCES:

- https://www.youtube.com/watch?v=bySfiuk5iHg
- Threat Modeling Tool 2016 User Guide.docx (live.com)

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CB102004	**MALWARE ANALYSIS AND PENETRATION TESTING**	3	-	2	-	4

Pre-Requisite	Computer Networks
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: This course provides a detailed discussion on Concepts and Types of Malware Analysis, Fingerprinting the Malware; Dynamic analysis monitoring tools, Dynamic Link Library Analysis; Downloader, persistence methods; Penetration Testing; Exploitation.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Understand the concepts and techniques of Malwares.
CO2. Analyze the techniques of Static and Dynamic methods to identify and classify Malwares.
CO3. Analyze the functionalities of malware by applying persistence methods.
CO4. Apply different Scanning tools to identify the vulnerabilities in the System or network.
CO5. Apply exploitation tools to gain access to the local and remote systems using password cracking.
CO6. Work independently and in teams to solve malware issues with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	-	2	-	-	-	-	-	-	-	3	3	-	-
CO2	3	3	2	3	-	-	-	-	-	-	-	-	3	3	-	-
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	3	-	-
CO4	3	2	3	2	2	-	-	-	-	-	-	-	3	3	-	-
CO5	3	2	3	2	2	-	-	-	-	-	-	-	3	3	-	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**3**	**-**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION AND STATIC ANALYSIS   *(09 Periods)*
Introduction: Malware Analysis, Why Malware Analysis, Types of Malware Analysis.
Static Analysis: Determining the File Type – Fingerprinting the Malware – Extracting Strings – Determining File Obfuscation – Comparing and Classifying the Malware.

Module 2:   DYNAMIC ANALYSIS   *(09 Periods)*
Dynamic Analysis: System and Network monitoring, Dynamic analysis monitoring tools, Dynamic Analysis Steps, Tools, Analyzing a Malware Executable, Dynamic Link Library (DLL) Analysis.

Module 3:   MALWARE FUNCTIONALITIES AND PERSISTENCE   *(09 Periods)*
Malware Functionalities: Downloader, Dropper, Keylogger, Malware Command Control, Power Shell-based Execution.
Persistence Methods: Scheduled Tasks – Startup Folder – Winlogon Registry Entries – Image

File Execution Options – COM hijacking – Service.

Module 4:   PENETRATION TESTING   *(09 Periods)*
Phases of penetration test; Reconnaissance - extracting information from DNS; scanning-pings and ping sweeps, Nmap: Port Scanning and Service Detection, Nessus: Vulnerability Scanning

Module 5:   EXPLOITATION   *(09 Periods)*
Gaining access to remote services; metasploit; password crackers- local and remote password cracking; password resetting

Total Periods: 45

EXPERIENTIAL LEARNING

1. Implement **Nmap** tool to sniff the network and perform auditing on the security of system.
2. Implement following using **Dmitry** for information gathering on the network
   a) subdomain search b)email-address search   c)TCP Portscan
3. Scan the website https://www.mbu.asia/ for any vulnerabilities using **Nikto**.
4. Configure **Zaproxy** tool in Mozilla firefox and trace the browser traffic.
5. Track the dictionary based attack on network using **sqlmap**
6. Perform thread based parallel testing on a network using **medusa**
7. Implement standard FMS attack using **aircrack-ng.**
8. Reverse the whole android application using **apktool.**
9. Implement spear-phishing attack using **set**
10. Implement IP and MAC spoofing using **Hamster**

RESOURCES

TEXT BOOKS:
1. Monnappa K A, *"Learning Malware Analysis: Learning Malware Analysis: Explore the concepts, tools, and techniques to analyze and investigate Windows malware",* Packet Publisher, 2018.
2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing", Elsevier Publication, 2nd Edition.

REFERENCE BOOKS:
1. Whitman &Mattord*, Principles of Incident Response and Disaster Recovery,* Course Technology ISBN: 141883663X.
2. Michael Ligh, Steven Stair.*"Malware Analyst's Cookbook and DVD: Tools and Techniques for Fighting Malicious Code",* Wiley Publishing Inc., 2011.
3. Alexey Kleymenov and AmrThabet, *"Mastering Malware Analysis: The complete malware analyst's guide to combating malicious software, APT, cybercrime, and IoT attacks",*Packt Publisher, 2019.
4. Jeremy Faircloth, "Penetration Tester's Open Source Toolkit", Third Edition, 2011.
5. Jason Andress and Ryan Linn, "Coding for Penetration Testers: Building Better Tools" by, 2011
6. Himanshu Sharma, "*Kali Linux - An Ethical Hacker's Cookbook*," Packt Publisher.

VIDEO LECTURES:
1. https://onlinecourses.nptel.ac.in/noc19_cs68/preview
2. https://www.coursera.org/learn/ibm-penetration-testing-incident-response-forensics
3. https://www.coursera.org/videos/security-awareness-training/aEwUH?query=malware&source=search

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CB102005	**ETHICAL HACKING**	3	-	2	-	4

Pre-Requisite Computer Networks
Anti-Requisite
Co-Requisite

COURSE DESCRIPTION:
The aim of the course is to introduce the methodologies and framework of ethical hacking for enhancing the security. The course includes-Impacts of Hacking; Types of Hackers; Information Security Models; Information Security Program; Business Perspective; Planning a Controlled Attack; Framework of Steps (Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Deliverable and Integration).

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1 Demonstrate knowledge on ethical hacking, framework, information security models and information security program.
CO2 Demonstrate the knowledge on interpreting the results of a controlled attack in business perspectives.
CO3 Apply techniques for Preparing for a Hack and Reconnaissance.
CO4 Apply Enumeration Techniques to identify penetration categories.
CO5 Apply security policies for incident management.
CO6 Work independently and in teams to solve hacking issues with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	3	3	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	3	3	-
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3	-
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3	-
CO5	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Course Correlation Mapping	3	3	2	2	2	-	-	-	3	3	-	-	3	3	3	-

Correlation Levels: *3: High;* *2: Medium;* *1: Low*

COURSE CONTENT

Module 1: INTRODUCTION (09 Periods)
Introduction: Hacking Impacts, The Hacker
Framework: Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, Integration
Information Security Models: Computer Security, Network Security, Service Security, Application Security, Security Architecture
Information Security Program: The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking
**Module 2: THE BUSINESS PERSPECTIVE AND PLANNING FOR (09 Periods)
  A CONTROLLED ATTACK**
Business Objectives, Security Policy, Previous Test Results, Business Challenges Inherent Limitations, Imposed Limitations, timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The

Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement

Module 3   PREPARING FOR A HACK AND RECONNAISSANCE   (08 Periods)
Technical Preparation, Managing the Engagement, Social Engineering, Physical Security, Internet Reconnaissance

Module 4   ENUMERATION AND EXPLOITATION   (11 Periods)
Enumeration Techniques, Soft Objective, Looking Around or Attack, Elements of Enumeration, Preparing for the Next Phase Intutive Testing, Evasion, Threads and Groups, Operating Systems, Password Crackers, RootKits, applications, Wardialing, Network, Services and Areas of Concern

Module 5   DELIVERABLE AND INTEGRATION   (08 Periods)
The Deliverable, The Document, Overall Structure, Aligning Findings, Presentation Integrating the Results, Integration Summary, Mitigation, Defense Planning, Incident Management, Security Policy, Conclusion

Total Periods: *45*

EXPERIENTIAL LEARNING
LIST OF EXERCISES:

1.   Practice the following Linux commands:
      ls,cat,cd,mkdir,nano,vim,rm,rmdir,nsloopup,chmod,ping,netstat,Kill..etc.

2.   Design and develop file systems and privileges in Linux Distribution.

3.   Set-up Linux distribution (Kali Linux, Parrot OS or Ubuntu) in the windows
      a) Vmware/VirtualBox
      b) Dual Boot
      c) Subsystems

4.   Use the following tools for identifying attacks:
      a) Nmap/Zenmap
      b)Google Hacking(Dorking)

5.   Perform the following in Web and Mobile Applications:
      a) Web Application
      Subdomain Finding, Live URL's Finding, Hacking History (Waybackurl's),GAU(Get All URL's).
      b)Android/IOS
      Source code Analysis (Java/Kotlin) tool (jadx-GUI)

6.   Using Burp suite perform penetration testing of web applications. (Installation of Burp suite, Configuration and setup Burp suite with Firefox in kali Linux and Windows)

7.   Perform password brute force attack through Burp suite (Dictionary Attacks).

8.   Perform DoS attacks with the help of Burp suite and its techniques
      i) Long Password/String DoS attack.
      2) JqL Injection.

9.   Perform SQL Injection, CSRF, SSTI, XSS(Java Script Injection), IDOR, Open Redirection. Identify the impact if a web application affected with these types of vulnerabilities.

10.   Hack Windows XP using nmap and metasploit.
      (These attack will be done in the virtual Box/VMware there will be two machines running in the windows one will be Attacker Machine(Kali Linux) other one is Windows XP(with Antivirus & Windows Protection "OFF").Using Nmap you have to find the IP of the Windows XP and further you need to proceed extracting the OS, Version, and The Older version is affected with Some CVE based vulnerabilities and by using Metasploit you need to exploit and takeover complete Windows Machine and perform Log-out command through Kali Linux.)

11. Perform Linux Distribution Deletion:
    a) Deleting in VMware/Virtual Box
    b) Deleting in Dual Boot.
    c) Deleting in Subsystem.

SOFTWARE/TOOLS:/HARDWARE TOOLS

1. Virtual Box/VMware , Kali Linux ISO file, Burpsuite.

2. The Particular Computer must have Virtualization Technology Enabled for sure.

TEXT BOOKS:

1. James S. Tiller, "The Ethical Hack: A Framework for Business Value Penetration Testing",Auerbach Publications, CRC Press

3. Web Application Hackers Handbook , Michael T. Simpson, Kent Backman, James E. "Corley, Hands-On Ethical Hacking and Network Defense", Second Edition, CENGAGE Learning, 2010.

REFERENCE BOOKS:

1.   Web Application hackers Hand Book(Dafydd Stuttard and Marcus Pinto), EC-Council, "Ethical Hacking and Countermeasures Attack Phases", Cengage Learning
2.   Michael Simpson, Kent Backman, James Corley, "Hands-On Ethical Hacking and NetworkDefense", Cengage Learning
3.   Steven DeFino, Barry Kaufman, Nick Valenteen, "Official Certified Ethical Hacker Review Guide", CENGAGE Learning.
4.   Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", Syngress Basics Series – Elsevier, August 4, 2011.
5.   Whitaker & Newman, " Penetration Testing and Network Defense" , Cisco Press, Indianapolis, IN, 2006.

WEB REFERENCES:
1. https://portswigger.net/web-security
2. https://www.elsevier.com/books/cyber-security-awareness-forlawyers
3. https://books.google.co.in/books

VIDEO LECTURES:
1. https://onlinecourses.nptel.ac.in/noc22_cs13/preview
2. https://portswigger.net/web-security (Practical Labs will also present with Video Lectues)

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CS102002	**PYTHON PROGRAMMING**	3	-	2	-	4

Pre-Requisite ‒

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Basics of Python programming, Control structures, Sequences, Sets, Dictionaries, Regular expressions, Functions, File handling, Object-oriented programming, Exception handling.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate knowledge on Python constructs, sequences, sets and dictionaries to solve basic computational problems.

CO2 Apply the concepts of regular expressions for searching patterns in strings.

CO3 Develop and use Python modules to provide solutions to problems.

CO4 Apply the knowledge of file operations in Python for file processing.

CO5 Design applications using object-oriented programming features – encapsulation, inheritance, polymorphism and exception handling.

CO6 Work independently to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	-	3	-	-	-	-	-	-	-	3	-	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	-	-	-
CO4	3	2	2	2	3	-	-	-	-	-	-	-	3	-	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	-	-	-
CO6	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO PYTHON PROGRAMMING   *(07 Periods)*

Introduction to Python, Tokens, Variables, Literals, Identifiers, Keywords, Special symbols, Operators, Fundamental datatypes, Expressions, Type conversions, Handling Input and output in Python.

Module 2:   CONTROL STRUCTURES   *(08 Periods)*

Selection Statements: if statement, if-else statement, if-elif-else statement, nested-if

statement.

Iterative Statements: while loop, for loop, break statement, continue statement, pass and else statements used with loops.

Module 3:   **SEQUENCES, SETS, DICTIONARIES AND REGULAR**   *(11 Periods)*
            EXPRESSIONS

Sequences: Lists and operations – Creating, Inserting elements, Updating elements, Deleting elements, Searching and sorting, List comprehensions, Nested lists; Tuples – Creating, Searching and sorting, Nested tuples; Strings – Initializing a string and string operations, String handling methods, String formatting.

Sets: Set creation, Set operations.

Dictionaries: Operations on dictionaries, Dictionary methods, Sorting elements using lambdas.

Regular Expressions: Regular expressions, Sequence characters in regular expressions, Quantifiers in regular expressions, Special characters in regular expressions.

Module 4:   **FUNCTIONS AND FILE HANDLING**   *(09 Periods)*

Functions: Need for functions, Function definition, Function call, Variable scope and lifetime, Return statement, Positional arguments, Keyword arguments, Default arguments and variable length arguments, Recursive functions, Lambda functions, Generators.

File Handling: Types of files, Opening and closing files, Reading and writing data.

Module 5:   **OBJECT ORIENTED PROGRAMMING AND EXCEPTION**   *(10 Periods)*
            HANDLING

Object Oriented Programming: Introduction to object-oriented programming, Classes and objects, Inheritance and polymorphism, Abstract Classes and interfaces.

Exception Handling: Errors in a python program, Exceptions, Exception handling, Types of exceptions, Except block, Assert statement, User defined exceptions.

Total Periods: 45

EXPERIENTIAL LEARNING
LIST OF EXERCISES:

1) Design a python script to the perform the various computations for the amount payable by the customer for Challenger Computers Store. A customer buying two numbers of SSD device, one SSD device cost is Rs. 3575/-. The stores offer 15% of the total cost. The customer has to pay 9% CGST, and 9% SGST. Prepare the Net Amount to be payable by the customer.

2) Design a python script to compute and generate the electricity bill as per the following slab rates. Collect the meter reading inputs, such as current unit and previous unit.

Consumption Units	Rate (in Rupees/Unit)
0-200	3.0
201-250	4.5
251-300	5.2

301-400	6.5
Above 400	7.0

3) Design a python script to display the sum of numbers divisible by 4. The code must allow the user to accept a number and add it to the sum if it is divisible by 4. It should repeatedly accepting numbers as long as the user wants to provide an input using an appropriate iterative statement and should display the final sum.

4) Food Corner home delivers vegetarian and non-vegetarian combos to its customer based on order. A vegetarian combo costs Rs.120 per plate and a non-vegetarian combo costs Rs.150 per plate. Their non-veg combo is really famous that they get more orders for their non-vegetarian combo than the vegetarian combo. Apart from the cost per plate of food, customers are also charged for home delivery based on the distance in kms from the restaurant to the delivery point. The delivery charges are as mentioned below:

Distance in kms	Delivery charge in Rs per km
For first 3kms	0
For next 3kms	3
For the remaining	6

Given the type of food, quantity (no. of plates) and the distance in kms from the restaurant to the delivery point, write a python program to calculate the final bill amount to be paid by a customer. The below information must be used to check the validity of the data provided by the customer.
- Type of food must be 'V' for vegetarian and 'N' for non-vegetarian.
- Distance in kms must be greater than 0.
- Quantity ordered should be minimum 1.
- If any of the input is invalid, bill amount should be considered as -1.

5) a) A list has the AP City Names [Tirupati, Kurnool, Kadapa]. Design a python script and perform the operations like, add 3 more AP City names Chittoor, Nellore, Guntur, insert Hyderabad in 3rd position, delete any two city names, update all city names as in Uppercase. Displays the list data, whenever an operation completes.
b) Design a python script for given an integer tuple, for each element in the tuple, check whether there exists a smaller element on the next immediate position of the tuple. If it exists print the smaller element. If there is no smaller element on the immediate next to the element then print -1.
Example: Input: 4 2 1 5 3   Output: 2 1 -1 3 -1

6) a) Sets n1 has the data {1, 3, 5, 7, 9}, n2 has the data {9, 5, 6, 8},
wd1=set(["Mon", "Tue", "Wed", "Thu", "Fri", "Sat", "Sun"]),
wd2=set(["Mon", "Tue", "Wed"]).
Design a python script to perform intersection, difference, and symmetric difference operations on the sets n1 and n2, and to perform superset, and subset operations on the sets wd1, and wd2.
b) The dictionary city_pin has the data {'Tirupati': 517101, 'Hyderabad': 500002, 'Chittoor': 517001,'Nellore': 524001}. Design a python script using lambda function to sort the dictionary on city name and produce the output and sort the dictionary on pincode and produce the output.
c) The string has the data, Wel_str = "Welcome to AI ML DS". Design a python script to search the pattern "AI" using regular expression search and display the three location numbers of the pattern. First shows the pattern starts location, second shows the pattern end location, and the last shows pattern span locations.

7) a) Design a python script for the mathematical puzzle, Towers of Hanoi. The puzzle has three rods and n disks. To move the entire stack to another rod, obeying the three rules (i) Only one disk can be moved at a time, (ii) Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack

i.e., a disk can only be moved if it is the uppermost disk on a stack, (iii) No disk may be placed on top of a smaller disk.

b) Design a python script to display the numbers that do not appear in the Fibonacci series of n numbers where n is given by the user. (If n is 8 then up to 8 Fibonacci numbers has to be printed Ex: 1 1 2 3 5 8 13 21 and in this series missing numbers should be traced and printed, Ex: missing numbers are: 4 6 7 9 10 11 12 14 15 16 17 18 19.

8) a) Design a function Learner_Age_Days with two formal parameters name, age and it computes Learner's age in days, then displays learners name and age in days.
(i) Design a driver code to call the function using positional arguments, keyword arguments
(ii) Apply the necessary changes in Learner_Age_Days function, and design a driver code to call the function using default arguments.

b) Design a python script using lambda and filter functions to construct an odd numbers list from numbers 1 to 10, and construct a negative numbers list from range of numbers -7 to 7 and to find the biggest number from a numbers list.

9) a) Design a python script to create a new file Collect_Literals_Phython.txt, collect the data from the keyboard about the contents of collection literals list, tuple, sets, dictionaries details, then write all the data into that file, and then close that file. Afterwards Open the Collect_Literals_Phython.txt file in read mode, read the entire contents of the file Collect_Literals_Phython.txt, then display all the contents of that file in monitor.

b) The file feat_python1.txt has the contents of features of the Python programming language. Design a python script to open that file feat_python1.txt in read mode, open the new file in feat_python2.txt in write mode, then read entire contents of the file feat_python1.txt, then copy all the contents of that file into the new file feat_python2.txt

10) a) Construct a Python script to implement the below requirements. Create a base class Basic_Info with data members name, rollno, gender and two member functions getdata() and display(). Derive a class Physical_Fit from Basic_Info which has data members height and weight and member functions getdata() and display(). Display all the information using object of derived class.

b) Design a Python script to implement the below specifications, compute, and produce required output. Define a class REPORT with the following specification

Private members
Admno	:	4-digit admission number
Name	:	20 characters
Marks	:	A list of 5 floating point values
Average	:	average marks obtained
GETAVG() a function to compute the average obtained in five subjects.		

Public members
READINFO() function to accept values for Adno, Name, Marks. Invoke the function GETAVG ().
DISPLAYINFO() function to display all data members of report on the screen. You should give function definitions. Write driver code to demonstrate all the functions.

11) a) The below scenarios will create Logical Error/Exception, and it will forcibly stop the execution in middle of the program. Design a Python Script the to handle these operations exceptions effectively, and avoid to stop the script execution in the middle.
. The variable num has the data 100, the value of num dividing by the value 0.
. To importing a library file matheqn, this library file not available in Python.
. A num_List has the values[10,20,30].To print the fifth value of num_List[5]
. A dictionary has the data, Dict_Univ = {'1':"MBU", '2':"Tirupathi", '3':"CSE"}. to print the fifth key value Dict_Univ[5]
b) Design a python script to collect the 10 students Python course mark. Check that entered mark is negative, then throw a user defined exception called Negative, otherwise store into the mark in the List Python_mark[].

RESOURCES

TEXT BOOKS:
1. R. Nageswara Rao, *Core Python Programming*, 3rd Edition, Dreamtech Press, 2021.
2. Paul J. Deitel, Harvey Deitel, Python for Programmers with Big Data and Artificial Intelligence Case Studies, Pearson, 2019.

REFERENCE BOOKS:
1. Charles Dierbach, *Introduction to Computer Science using Python: A Computational Problem Solving Focus*, Wiley India, 2016.
2. Christian Hil, Learning Scientific Programming with Python, 2nd Edition, Cambridge University Press, 2020.

SOFTWARE/TOOLS:
1. Python 3.10
2. Jupyter Notebook/JupyterLab/IDLE/Google CoLab

VIDEO LECTURES:
1. https://onlinecourses.nptel.ac.in/noc19_cs41/preview
2. https://www.coursera.org/specializations/python
3. https://www.coursera.org/learn/python-for-applied-data-science-ai
4. https://www.youtube.com/watch?v=WGJJIrtnfpk
5. https://www.youtube.com/watch?v=_uQrJ0TkZlc
6. https://www.udemy.com/topic/python/
7. https://freevideolectures.com/course/2512/python-programming

WEB RESOURCES:
1. https://www.w3schools.com/python/
2. https://www.programiz.com/python-programming
3. https://www.geeksforgeeks.org/python-programming-language/
4. https://www.javatpoint.com/python-lists
5. https://www.learnpython.org/

Course Code	Course Title	L	T	P	S	C
22CS102003	**DATA STRUCTURES**	3	-	2	-	4

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides an overview of data structure concepts, arrays, stack, queues, trees, and graphs. Discussion of various implementations of these data objects, programming styles, and run-time representations.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Understand the concept of Dynamic memory management, data types, algorithms, Big O notation.
CO2. Understand basic data structures such as arrays, linked lists, stacks and queues.
CO3. Solve problem involving graphs, trees and heaps.
CO4. Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: **3: High;**   **2: Medium;**   **1: Low**

COURSE CONTENT

MODULE 1   **INTRODUCTION TO DATA STRUCTURES & STACK, QUEUE**   **(10 *Periods*)**
Introduction: Introduction to Data Structures, Basic Concepts and Notations, Abstract Data Types, Analysis and Efficiency of Algorithms, Time and Space Complexity.
Stack, Queue: Stack, Stack operations, Implementation using arrays, applications of stack, Queue, Queue operations, Implementation using arrays, various Queue Structures, applications of queue.

MODULE 2   **LINKED LISTS**   **(8 *Periods*)**
Linked lists: Single linked list, double linked list, circular linked list, operations on linked lists, Applications of Linked List. Implementation of stack using Pointers, Implementation of Queue using Pointers.

MODULE 3   **SEARCHING, SORTING & HASH TABLES**   **(8 *Periods*)**
Searching Techniques: Linear Search, Binary Search and Fibonacci Search.
Sorting Techniques: Selection Sort, Insertion sort, Bubble sort, Merge Sort, Quick Sort, Heap sort, Radix Sort.
Hash Tables: Hash Functions, Collision Handling Schemes, Applications.

MODULE 4   **TREES**   **(10 *Periods*)**
Trees: Vocabulary and Definitions, Binary Tree, Implementation, Binary Tree Traversal, Binary Search Tree, Implementation, Balanced Search Trees: AVL Trees, Implementation,

Splay Trees, Red-Black Trees.

MODULE 5   GRAPH THEORY   (09 *Periods*)
GraphTheory: Graphs Terminology, Graph ADT, Data Structures for Graphs –Adjacency Matrix Structure, Graph Traversals, Shortest Paths, Minimum Spanning Trees- Prims' Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Floyd-Warshall Algorithm
Total Periods: 45

EXPERIENTIAL LEARNING:
1. Demonstrate recursive algorithms with examples.
2. Develop a program to perform operations of a Stack and Queue using arrays.
3. Implement and perform different operations on Single, Double and Circular Linked Lists.
4. Develop a program to perform operations of Stack and Queue using Linked Lists
5. Develop programs to implement Stack applications.
6. Implement Circular Queues.
7. Implement various Searching techniques.
8. Develop programs for different Sorting techniques
9. Develop a program to represent a Tree data structure.
10. Develop a program to demonstrate operations on Binary Search Tree.
11. Demonstrate Graph Traversal Techniques.
12. Develop a program to find Minimum cost Spanning tree.

RESOURCES:
Text Books:
1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson, Second Edition, 2002.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein Introduction to Algorithms, PHI, Third Edition,2010.
3. Narasimha Karumanchi, Data Structures and Algorithms Made Easy, Career Monk Publications,2020.

Reference Books:
1. Horowitz, Sahani, Anderson Freed, Fundamental of Data Structures in C, Universities Press, Second Edition, 2008.
2. Debasis Samantha, Classic Data Structures, PHI, Second Edition, 2009.

VIDEO RESOURCES:
1. https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F
2. https://www.youtube.com/watch?v=S47aSEqm_0I&list=PLD9781AC5EBC9FA16
3. https://www.youtube.com/watch?v=9MmC_uGjBsM&list=PLyqSpQzTE6M_Fu6l8irVwXkUy C9Gwqr6

WEB RESOURCES:
1. https://www.tutorialspoint.com/what-is-advanced-java

2. https://www.udemy.com/course/advanced-java-programming/

3. https://www.geeksforgeeks.org/what-is-advanced-java/

4. https://cloudacademy.com/learning-paths/advanced-java-programming-518/

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CS102004	**DESIGN AND ANALYSIS OF ALGORITHMS**	3	-	2	-	4

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Algorithms and asymptotic notations; Algorithm performance analysis; Amortized analysis; Recurrences; Disjoint sets; Divide and Conquer; Dynamic programming; Greedy algorithms; Back tracking; Branch and bound; NP-hard and NP-complete problems.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze the complexity of algorithms by applying the knowledge of asymptotic notations and recurrence methods.

CO2. Analyze the given problem and identify appropriate algorithm design technique for problem solving.

CO3. Perceive and apply different algorithm design paradigms to find solutions for computing problems.

CO4. Apply the knowledge of NP-hard and NP-Complete complexity classes to classify decision problem.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2		-	-	-	-	-	-	-	-	-	3	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**

Correlation Levels: **3: High;**   **2: Medium;1: Low**

COURSE CONTENT

Module 1:   INTRODUCTION TO ALGORITHMS   (10 Periods)
Algorithm, Algorithm pseudocode conventions, Performance analysis - Space complexity, Time complexity, Asymptotic notations; Amortized analysis – Aggregate analysis, Accounting method, Potential method; Recurrences - Substitution method, Recursion-tree method, Master method.

Module 2:   DISJOINT SETS, DIVIDE AND CONQUER   (08 Periods)
Disjoint Sets: Operations, Union and Find algorithms.
Divide and Conquer: General method, Defective chess board, Binary search, Finding maximum and minimum, Merge sort, Strassen's matrix multiplication.

Module 3   DYNAMIC PROGRAMMING   (9 Periods)
General method, Matrix-chain multiplication, All pairs shortest path, Optimal binary search trees, 0/1 Knapsack problem, Traveling salesperson problem, Flow shop scheduling.

Module 4   GREEDY METHOD, BACKTRACKING   (10 Periods)
Greedy Method: General method, Knapsack problem, Job sequencing with deadlines, Huffman codes, Single source shortest paths, Optimal merge patterns.
Backtracking: General method, 8–Queens problem, Sum of subsets, Graph coloring, Hamiltonian cycles.

Module 5   BRANCH AND BOUND, NP-HARD AND NP-   (08 Periods)
**   COMPLETE PROBLEMS**
Branch and Bound: LC search, LC branch and bound, FIFO branch and bound, 0/1 knapsack problem, Traveling salesperson problem.
NP Hard and NP-Complete Problems: Nondeterministic algorithms, NP-hard and NP-complete classes, Cook's theorem, NP-hard scheduling problems – Scheduling identical processors.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1.   Sort a given set of n integer elements using Quick Sort and merge sort methods and compute its time complexities. Run the programs for varied values of n >1000 and record the time taken to sort. Plot a graph of the time taken versus n for both algorithms. The elements can be read from a file or can be generated using the random number generator. Demonstrate how the divide and conquer method works along with its time complexity analysis: worst case, average case and best case.
2.   Write a program to implement knapsack problem using greedy method.
3.   a) Write a program to find minimum cost spanning tree using Kruskal's Algorithm.
     b) Write a program to find minimum cost spanning tree using Prim's Algorithm.
4.   Write a program to implement 0/1 Knapsack problem using Dynamic Programming method.
5.   Write a program to implement All-Pairs Shortest Paths problem using Floyd's algorithm.
6.   Write a program to implement Travelling Sales Person problem using Dynamic programming method.
7.   Write a program to implement backtracking algorithm for the N-queens problem.
8.   Write a program to find a subset of a given set S = {Sl, S2,.....,Sn} of n positive integers whose SUM is equal to a given positive integer d. For example, if S ={1, 2, 5, 6, 8} and d= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance doesn't have a solution.
9.   Write a program to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

RESOURCES
TEXT BOOKS:

1.   Ellis Horowitz, SartajSahni, and SanguthevarRajasekaran, Fundamentals of Computer Algorithms, 2nd Edition, Universities Press, 2008.
2.   Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms,3rd Edition, MIT Press, 2009.

REFERENCE BOOKS:

1.   Michael T. Goodrich and Roberto Tamassia, Algorithm Design and Applications, Wiley, 2014.
2.   Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, The Design and Analysis of Computer Algorithms, Pearson, 2006.

SOFTWARE/TOOLS:

1. Software: JDK 1.8
2. OperatingSystem:Windows/Linux

VIDEO LECTURES:

1. https://www.digimat.in/nptel/courses/video/106101060/L01.html
2. http://www.infocobuild.com/education/audio-video-courses/computer-science/DesignAnalysisOfAlgorithms-IIT-Bombay/lecture-05.html

WEB RESOURCES:

1. https://www.tutorialspoint.com/design-and-analysis-of-an-algorithm/index.asp
2. https://nptel.ac.in/courses/106/106/106106131

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CS102005	**DATABASE MANAGEMENT SYSTEMS**	3	-	2	-	4

Pre-Requisite   -
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: Introduction to database systems; Database design; Relational model; Relational algebra; SQL queries; Constraints and triggers; PL/SQL; Schema refinement and normal forms; Transaction management; Concurrency control; Overview of storage and indexing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Apply the concepts of ER-modeling and normalization to design viable data models for a given problem.
CO2. Formulate relational database schemas, apply suitable integrity constraints, for querying databases.
CO3. Use SQL to store, query, and manipulate data in relational databases.
CO4. Develop PL/SQL blocks to centralize database applications for maintainability and reusability.
CO5. Analyze transaction processing, concurrency control and storage methods for database management.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	3	-	-	-	-	2	-	-	-	-	-	3	-	3
CO3	3	3	3	-	-	-	-	-	-	-	2	-	3	-	3
CO4	2	3	3	-	-	-	-	2	-	-	-	-	3	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**2**	**-**	**3**	**-**	**3**

Correlation Levels: 3: High;   2: Medium;1: Low

COURSE CONTENT
Module 1:   **INTRODUCTION TO DATABASE SYSTEMS AND**   *(09 Periods)*
                DATABASE DESIGN
Introduction to Database Systems: Database system applications, Purpose of database systems, View of data - Data abstraction, Instances and schemas, Data models; Database languages - Data Definition Language, Data Manipulation Language; Database architecture, Database users and administrators.
Introduction to Database design: Database design and ER diagrams, Entities, attributes and entity sets, Relationships and relationship sets, Additional features of ER model, Conceptual Design with ER model.
Module 2:   **RELATIONAL MODEL, RELATIONAL ALGEBRA AND**   *(08 Periods)*
                TUPLE CALCULUS
Relational Model: Creating and modifying relations, Integrity constraints over relations, Enforcing integrity constraints, Querying relational data, Logical database design, Introduction to views, Destroying/altering tables and views.
Relational Algebra and Tuple calculus: Preliminaries, Relational Algebra operators and tuple calculus.

Module 3:   SQL AND PL/SQL   *(09 Periods)*

SQL: Form of basic SQL query, Nested queries, Aggregate operators, Null values, Complex integrity constraints in SQL, Triggers and active databases.

PL/SQL: Generic PL/SQL block, PL/SQL data types, Control structure, Procedures and functions, Cursors, Database triggers.

Module 4:   SCHEMA REFINEMENT AND TRANSACTIONS   *(10 Periods)*

Schema Refinement: Problems caused by redundancy, Decompositions, Problems related to decomposition, Functional dependencies, Reasoning about FDs, First normal form, Second normal form, Third normal form, Boyce-Codd normal form, Multivalued dependencies, Fourth normal form, Join dependencies, Fifth normal form.

Transactions: Transaction concept, Transaction atomicity and durability, Concurrent Executions – Serializability, Recoverability, Implementation of isolation, Testing for serializability.

Module 5:   CONCURRENCY CONTROL, STORAGE AND INDEXING   *(09 Periods)*

Concurrency Control: Lock Based Protocols, Timestamp Based Protocols, Validation Based Protocols, Multiple Granularity, Deadlock Handling.

Storage and Indexing: Data on external storage, File organizations and indexing – Clustered indexes, Primary and secondary indexes; Index data structures – Hash based indexing, Tree based indexing; B and B+ Trees, Comparison of file organizations.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1.Design and analyze an ER Model for the following use case.
The Library Management System database keeps track of readers with the following considerations –
•   The system keeps track of the staff with a single point authentication system comprising login Id and password.
•   Staff maintains the book catalog with its ISBN, Book title, price(in INR), category(novel, general, story), edition, author Number and details.
•   A publisher has publisher Id, Year when the book was published, and name of the book.
•   Readers are registered with their user_id, email, name (first name, last name), Phone no (multiple entries allowed), communication address. The staff keeps track of readers.
Choose appropriate Entities and attributes and relationships and draw the complete ER diagram.
2.a). Implement Data Definition Language commands -Create, Alter, Drop, Truncate, and Rename.
b). Implement Data Manipulation Language commands - Insert, Select, Update, and Delete.
c).Implement Single Row functions - Character, Numeric and Date functions.

3.Implement various types of integrity constraints - NOT NULL constraint, DEFAULT constraint, UNIQUE constraint, PRIMARY key, FOREIGN key, CHECK constraint.

4.a).Implement group functions with different operators such as aggregate operators, group by, having and order by.
b).Implement nested and correlated nested queries using set operators and set comparison operators.

5. a).Creation of views, synonyms, sequence, indexes and save point.
b). Implement various types of joins - outer join and inner join.

Basic PL/SQL:
6. Construct PL/SQL block for the following:
a.   To determine whether a number is palindrome
b.   To determine whether a number is an Armstrong number
c.   To find greatest of three numbers
d.   To display Fibonacci series

Control Structures:
7.a) Write a program in PL/SQL to update the salary of a specific employee by 20% if the salary less than 30000/- and 10% when the salary in between 30000/- and 60000/- and 5% when the salary is above 60000/- and display the salary with a suitable message.
b).Write a PL/SQL program to display the description of the grade against a student's grade using CASE statement.

Exception Handling:
8. a). Develop a PL/SQL program that displays the name and address of a student whose ID is given. If there is no student with the given student ID in the database, the program should raise a run-time exception NO_DATA_FOUND, which should be captured in the EXCEPTION block.
b). Construct the user-defined exceptions to get the salary of an employee and check it with the job's salary range. If the salary is below the range, raise an exception BELOW_SALARY_RANGE. If the salary is above the range, raise the exception ABOVE_SALARY_RANGE.

Functions:
9.a).Write a function that accepts two numbers A and B and performs the following operations.
1.   Addition
2.   Subtraction
3.   Multiplication
4.   Division

b).Write a PL/SQL block that reverses the given number.

Procedures:
10. a).Write a procedure that accepts two numbers and displays their sum.
b).Write procedures to demonstrate IN, IN OUT and OUT parameters.

Cursors:
11.a).Write a block in PL/SQL to create a Cursor that displays the employee name and number of jobs he or she has done in the past.
b). Write a program in PL/SQL to create a cursor to display the name and salary of each employee in the EMPLOYEES table whose salary is less than that specified by a passed-in parameter value.

Triggers:
12.Develop a suitable employee database application by considering appropriate attributes.
a).Whenever the inserted or updated salary is more than 10 lacs per month a trigger should be fired.

b).Whenever, the inserted or updated salary is less than 5000 per month a trigger should be activated.

RESOURCES

TEXT BOOKS:
1.   William Stallings, Computer Organization and Architecture: Design for performance, Pearson, 11th Edition, 2020.

REFERENCE BOOKS:
1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, McGraw Hill Education, 2013.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design - A Hardware software interface, 5th Edition, Morgan Kaufmann, 2014.

VIDEO LECTURES:
1. https://onlinecourses.nptel.ac.in/noc21_cs37/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs64/preview
3. https://onlinecourses.nptel.ac.in/noc21_cs47/preview
4. https://freevideolectures.com/course/2277/computer-organization
5. https://www.youtube.com/watch?v=4TzMyXmzL8M

WEB RESOURCES:
1. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
2. https://www.geeksforgeeks.org/last-minute-notes-computer-organization/
3. https://gateoverflow.in/blog/9728/some-good-resources-for-computer-organisation-architecture
4. https://tutorialspoint.dev/computer-science/computer-organization-and-architecture/

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22CS102006	**COMPILER DESIGN**	3	-	2	-	4

Pre-Requisite   Theory of Computation

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: Lexical analysis; Parsers; Run Time Environments; Syntax Directed Translation; Type checking; Code Optimization; Code Generation and Compiler tools.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on the phases involved in design of compilers.

CO2. Analyze code optimization Techniques.

CO3. Design experiments for implementing parsing techniques.

CO4. Synthesize rules in compiler to demonstrate semantic attribution during Parsing.

CO5. Use compiler construction tools such as LEX and YACC for designing a Parser.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	3	-	-	-	-	2	-	-	-	-	-	3	-	3
CO3	3	3	3	-	-	-	-	-	-	-	2	-	3	-	3
CO4	2	3	3	-	-	-	-	2	-	-	-	-	3	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**2**	**-**	**3**	**-**	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

MODULE I– INTRODUCTION TO COMPILER AND LEXICAL ANALYSIS   (09 Periods)

Structure of a compiler, Interpretation- Interpreters, Recursive interpreters, Iterative interpreters. Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Specification of Tokens, The Lexical-Analyzer Generator LEX.

MODULE II – SYNTAX ANALYSIS (09 Periods)

The Role of the Parser, Eliminating Ambiguity, Eliminating of Left Recursion and Left Factoring. Top-Down Parsing: Recursive descent parsing, Non Recursive Predictive parsing, LL (1) Grammars, A traditional top-down parser generator—YACC

Bottom-Up Parsing: Shift reduce parsing, LR parsers – Simple LR parser, Canonical LR parser, LALR parser, Using Ambiguous Grammars.

MODULE III – SYNTAX DIRECTED TRANSLATION AND TYPE CHECKING (09 Periods)

Syntax directed definition, S-attributed and L-attributed definitions, Construction of syntax trees. Type Checking: Type Expressions, Type Equivalence, Rules for Type Checking, Type Conversions, Overloading of Functions and Operators.

MODULE IV – INTERMEDIATE CODE GENERATOR AND RUN TIME ENVIRONMENTS

(09 Periods)

Preprocessing the intermediate code, Preprocessing of expressions, Preprocessing of if-statements and goto statements, Preprocessing of routines, Variants of Syntax Trees, Three Address Code, Boolean expressions, Flow-of-Control Statements, Control- Flow Translation of Boolean Expressions.

Run time Environments: Storage organization, Stack Allocation of Space, Access to Nonlocal Data on the Stack.

MODULE V – CODE OPTIMIZATION AND CODE GENERATION (09 Periods)

Basic Blocks and Flow Graphs, Optimization of Basic Blocks, The principal sources of optimization, Introduction to data flow analysis.

Code Generation: Issues in the Design of a Code Generator, The Target Language, Simple Code Generator, Peephole optimization, Register allocation and assignment.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Write a LEX Program to scan reserved word & Identifiers of C Language language.

2. Implement Predictive Parsing algorithm.

3. Write a C program to generate three address code.

4. Implement SLR(1) Parsing algorithm.

5. Design LALR bottom up parser for the given language.

6. Write a C program for implementing the functionalities of predictive parser for the mini language specified in Note 1.

7. Write a C program for construction of LL (1) parsing.

8. Write a C program for constructing recursive descent parsing.

9. Implement a desk calculator using operator precedence parsing.

10. Consider the syntax of a programming language construct such as while-loop --

while (condition)

begin

statement ;

:

end

where while, begin, end are keywords; condition can be a single comparision expression (such as x == 20, etc.); and statement is the assignment to a location the result of a single arithmatic operation (eg., a = 10 * b).

Write a program that verifies whether the input follows the above syntax.

TEXT BOOK:

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers–Principles, Techniques and Tools, Pearson Education, 2nd edition, 2012.

REFERENCE BOOKS:

1. Dick GruneKees van Reeuwijk Henri, Modern Compiler Design, Springer,2nd edition, 2012.

2. David Galles, Modern Compiler Design, Pearson Education Asia, 2007.

SOFTWARE/TOOLS:

1. Software: Turbo C++/Dev C++

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106104123

2. https://www.reddit.com/r/Compilers/comments/10dpnky/compiler_design_theory_course_with_video _lectures/?rdt=44592

WEB RESOURCES:

1. https://nitsri.ac.in/Department/Computer%20Science%20&%20Engineering/CD-LEC-NOTES.pdf

2. http://www2.cs.uidaho.edu/~jeffery/courses/nmsu/370/lecture.html

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22IT104001	**WEB TECHNOLOGIES**	3	-	2	4	5

Pre-Requisite	Object Oriented Programming through Java
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: Hyper Text Markup Language (HTML); Features of HTML5; Cascading Style Sheets (CSS); JavaScript; JQuery; Bootstrap; Hypertext Preprocessor (PHP); MySQL.

COURSE OUTCOMES: *After successful completion of this course, the students will be able to:*

CO1. Demonstrate knowledge on web page design elements, dynamic content and database connection.

CO2. Analyze user requirements to develop web applications.

CO3. Design client-server applications using web technologies.

CO4. Demonstrate problem solving skills to develop enterprise web applications.

CO5. Apply HTML, CSS, JavaScript, JQuery, Bootstrap and PHP technologies for device independent web application development.

CO6. Apply web technologies to develop interactive, dynamic and scalable web applications for societal needs.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	2	3	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	2	3	-
CO3	3	3	3	2	2	-	-	-	-	-	-	-	3	2	3	-
CO4	3	3	3	2	2	-	-	-	-	-	-	-	2	2	3	-
CO5	3	2	2	2	2	3	-	-	-	-	-	-	2	2	3	-
CO6	-	-	-	2	-	-	-	-	3	3	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**2**	**2**	**3**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**2**	**3**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT:

Module-1: HTML   **(09 periods)**
Introduction: Fundamentals of HTML, Working with Text, Organizing Text in HTML, Working with Links and URLs, Creating Tables, Working with Images, Canvas, Forms, Frames and Multimedia.
HTML5: Introduction, HTML5 Document Structure, Creating Editable Content, Checking Spelling Mistakes, Exploring Custom Data Attributes, Client-Side Storage, Drag and Drop Feature, Offline Web Applications, Web Communications, Cross-Document Messaging and Desktop Notifications.

Module-2: CSS AND JAVASCRIPT   **(10 periods)**
CSS: Introduction, CSS Selectors, Inserting CSS in an HTML document, Backgrounds, Fonts, and Text Styles, Creating Boxes, Displaying, Positioning and Floating Elements, Features of CSS3, Media Queries.
Javascript: Overview of JavaScript, JavaScript Functions, Events, Image Maps and Animations, JavaScript Objects, Working with Browser and Document Objects, JQuery **-** Introduction, JQuery Selectors, Events, Methods to access HTML elements and attributes, Introduction to AJAX.

Module-3: BOOTSTRAP   **(09 periods)**
Getting Started with Bootstrap, Creating Responsive Layouts Using Bootstrap CSS - Basic HTML structure for Bootstrap, Responsive classes, Rendering images, The grid system, Constructing data entry forms, Packaged Components in Bootstrap - The page header, Glyphicons, The navigation bar, Badges, Alerts, Toolbars and button groups, Panels.

Module-4: INTRODUCTION TO PHP   **(09 periods)**
Introduction, Data Types, Variables, Constants, Expressions, String Interpolation, Control Structures, Functions, Arrays, Embedding PHP Code in Web Pages, Object Oriented PHP.

Module-5: PHP WEB FORMS AND MYSQL   **(08 periods)**
PHP Web forms: PHP and Web Forms, Sending Form Data to a Server, Working with Cookies and Session Handlers
PHP with MySQL: Interacting with the Database, Prepared Statement, Database Transactions.

                                                   Total Periods: 45

EXPERENTIAL LEARNING

List of Exercises:

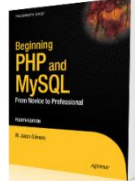1. Design the following static web pages of an online book store web application.

    a. Home Page:

b. Catalogue Page:

The catalogue page should display the following details of available books.

    i. Snap shot of cover page   ii. Title of the text book   iii. Author name
    iv. Publisher   v. Price   vi. More details link.

c. Registration Page:

Design the Registration page with the following fields and navigate it with create an account link.

    i. First Name   ii. Last Name   iii. Gender
    iv. Date of Birth   v. Username   vi. Password
    vii. Confirm Password   viii. Address   ix. Postal Code
    x. Mobile No.   xi. Email-Id

2. a. Design a web page to store username and password information using the local storage concept.
   b. Design a web page to store employee information including Name, Emp. Id, Department, Salary and Address on a client's machine using a real SQL database.

3. Apply the following styles to all web pages of online book store web application.
   a. Fonts and Styles: font-family, font-style, font-weight and font-size
   b. Backgrounds and colors: color, background-color, background-image and background-repeat
   c. Text: text-decoration, text-transformation, text-align and text-indentation, text-align
   d. Borders: border, border-width, border-color and border-style
   e. Styles for links: A: link, A: visited, A:active, A:hover
   f. Selectors, Classes, Layers and Positioning elements.

4. Write a JavaScript/JQuery code to validate the following fields of the Registration web page.
   a. First Name/Last Name - should contain only alphabets and the length should not be less than 8 characters.
   b. Username - It should contain combination of alphabets, numbers and underscore. It should not allow spaces and special symbols.
   c. Password - It should not less than 8 characters in length and it contains one uppercase letter and one special symbol.
   d. Date of Birth - It should allow only valid date; otherwise display a message stating that entered date is invalid. Ex. 29 Feb. 2009 is an invalid date.
   e. Postal Code: It must allow only 6 digit valid number.
   f. Mobile No. - It should allow only numbers and total number of digits should be equal to 10.
   g. e-mail id - It should allow the mail id with the following format:
      Ex. mailid@domainname.com

5. Design a web page with the following features using HTML5, JavaScript and JQuery
   a. Displaying of images with Custom animated effects
   b. Playing of selected video from the list of videos
   c. Showing the animated text in increasing and decreasing font size
   d. Changing the size of the area in a web page using DIV tag
   e. Hiding and Showing elements in a web page.

6. Design a web page with the following features using Bootstrap and Media Query.
   a. Components
   b. Responsive tables
   c. Responsive images and videos
   d. Toolbars, Buttons and Lists

7. a. Deploy and navigate web pages of online book store using WAMP/XAMPP web server.
   b. Write a PHP program to read user name and favorite color from the HTML form. Display the name of the user in green color and sets user favorite color as a background for the web page.

8. Write a PHP code to read the username and password entered in the Login form of the online book store and authenticate with the values available in cookies. If user enters a valid username and password, welcome the user by username otherwise display a message stating that, entered details are invalid.

9. Write a PHP code to read user details entered through the registration web page and store the same into MySQL database.

10. Write a PHP code for storing books details like Name of the book, author, publisher, edition, price, etc into MySQL database. Embed a PHP code in catalogue page of the online book store to extract books details from the database.

RESOURCES

TEXT BOOKS:

1. Kogent Learning Solutions Inc, *HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery*, Dreamtech Press, First Edition, 2011.

2. W. Jason Gilmore, *Beginning PHP and MySQL*, APress, Fourth Edition, 2011.

REFERENCE BOOKS:

1. Snig Bahumik, *Bootstrap Essentials*, PACKT Publishing, First Edition, 2015 (e-book).

2. Thomas A. Powell, *The Complete Reference: HTML and CSS,* Tata McGraw Hill, Fifth Edition, 2010.

3. Andrea Tarr, *PHP and MySQL*, Willy India, First Edition, 2012.

WEB RESOURCES:

1. https://www.w3schools.com/php/DEFAULT.asp
2. https://www.w3schools.com/js/

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CS101005	**DISTRIBUTED SYSTEMS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course focuses on the fundamental principles and models underlying all aspects of distributed computing. It includes topics that covers the principles underlying the theory, algorithms, and systems aspects of distributed computing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Identify the design issues; select appropriate system and mode of execution to address challenges in creating a distributed systems.

CO2. Utilize the concept of causality between events for designing and analyzing distributed systems.

CO3. Record the global state of a distributed system for analyzing, testing, or verifying properties associated with distributed executions.

CO4. Implement various approaches for solving distributed mutual exclusion problem and compare their feature and performance.

CO5. Study several distributed deadlock detection techniques based on various strategies and solve deadlock problem

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	3	-	-	-	-	2	-	-	-	-	-	3	-	3
CO3	3	3	3	-	-	-	-	-	-	-	2	-	3	-	3
CO4	2	3	3	-	-	-	-	2	-	-	-	-	3	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**2**	**-**	**3**	**-**	**3**

Correlation Levels: **3: High;** **2: Medium;1: Low**

Module 1 – INTRODUCTION **(9 Periods)**

Relation to parallel multiprocessor/multicomputer systems - Message-passing systems versus shared memory systems - Synchronous versus asynchronous executions - Design issues and challenges - A model of distributed executions - Models of communication networks - Past and future cones of an event - Models of process communications

Module 2 - LOGICAL TIME **(9 Periods)**

A framework for a system of logical clocks - Scalar time - Vector time - Efficient implementations of vector clocks - Jard–Jourdan's adaptive technique - Matrix time - Virtual time - Physical clock synchronization: NTP

Module 3 - GLOBAL STATE AND SNAPSHOT RECORDING ALGORITHMS **(9 Periods)**

Global state and snapshot recording algorithms - Snapshot algorithms for FIFO channels - Variations of the Chandy–Lamport algorithm - Snapshot algorithms for non-FIFO channels - Snapshots in a causal delivery system - Monitoring global state

Module 4 - DISTRIBUTED MUTUAL EXCLUSION ALGORITHMS **(9 Periods)**

Lamport's algorithm - Ricart–Agrawala algorithm - Singhal's dynamic information-structure algorithm - Lodha and Kshemkalyani's fair mutual exclusion algorithm - Quorum-based mutual exclusion algorithms - Maekawa's algorithm - Agarwal–El Abbadi quorum-based algorithm - Token-based algorithms - Suzuki–Kasami's broadcast algorithm - Raymond's tree-based algorithm.

Module 5 - DEADLOCK DETECTION IN DISTRIBUTED SYSTEMS **(9 Periods)**

System model - Models of deadlocks - Knapp's classification of distributed deadlock detection algorithms - Mitchell and Merritt's algorithm for the singleresource model - Chandy–Misra–Haas algorithm for the AND model - Chandy–Misra–Haas algorithm for the OR model - Distributed shared memory - Abstraction and advantages - Memory consistency models.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Implement concurrent echo client-server application
2. Implement concurrent day-time client-server application.
3. Create CORBA based server-client application.
4. Implementing Publish/Subscribe Paradigm using Web Services, ESB and JMS.
5. Test open source ESB using web service.

TEXT BOOK

1. Kshemkalyani Ajay D, Mukesh Singhal, Distributed Computing: Principles, Algorithms and Systems, Cambridge Press, 2011.
   Reference Books

1. George Coulouris, Jean Dollimore, Time Kindberg, Distributed Systems Concepts and Design, Fifth Edition, Pearson Education, 2012.
2. Pradeep L Sinha, Distributed Operating Systems: Concepts and Design, Prentice Hall of India, 2007.

3. Tanenbaum A S, Van Steen M, Distributed Systems: Principles and Paradigms, Pearson Education, 2007.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=UEAMfLPZZhE
2. https://www.digimat.in/nptel/courses/video/106106168/L01.html

WEB RESOURCES:
1. https://www.cl.cam.ac.uk/teaching/2122/ConcDisSys/dist-sys-notes.pdf
2. https://lass.cs.umass.edu/~shenoy/courses/677content/CourseNotes.pdf

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
	5G TECHNOLOGIES	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Overview of 5G Broadband Wireless Communications, The 5G wireless Propagation Channels, Transmission and Design Techniques for 5G, Device-to-device (D2D) and machine-to-machine (M2M) Communication, and Millimeter-wave Communications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand 5G and 5G Broadband Wireless Communications

CO2. Understand 5G wireless Propagation Channels

CO3. Understand the significance of transmission and Design Techniques for 5G

CO4. Analyze Device-to-device (D2D) and machine-to-machine (M2M) type communications

CO5. Learn Massive MIMO propagation channel models

CO-PO Mapping Table:

Course Outcomes	Program Outcomes									
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	-	-	-	-	3	1	-	-	-
CO2	3	1	-	-	-	-	-	-	3	-
CO3	3	1	3	-	-	-	-	-	-	1
CO4	2	1								1
CO5	3	-	-	-	-	3	1	-	-	-
Course Correlation Mapping	**3**	**1**	**3**	**-**	**-**	**3**	**1**	**-**	**3**	**1**

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT

Module 1: **Overview of 5G Broadband Wireless Communications** *(09 Periods)*

Evolution of mobile technologies 1G to 4G (LTE, LTEA, LTEA Pro), An Overview of 5G requirements, Regulations for 5G, Spectrum Analysis and Sharing for 5G.

Module 2: **The 5G wireless Propagation Channels** *(09 Periods)*

Channel modeling requirements, propagation scenarios and challenges in the 5G modeling, Channel Models for mmWave MIMO Systems.,3GPP standards for 5G

Module 3: **Transmission and Design Techniques for 5G** *(09 Periods)*

Basic requirements of transmission over 5G, Modulation Techniques – Orthogonal frequency division multiplexing (OFDM), generalized frequency division multiplexing (GFDM), filter bank multi-carriers (FBMC) and universal filtered multi-carrier (UFMC), Multiple Accesses Techniques – orthogonal frequency division multiple accesses (OFDMA), generalized frequency division multiple accesses (GFDMA), non-orthogonal multiple accesses (NOMA).

Module 4: **Device-to-device (D2D) and machine-to-machine** *(09 Periods)*
           (M2M) Communication

Device-to-device (D2D) and machine-to-machine (M2M) type communications – Extension of 4G D2D standardization to 5G, radio resource management for mobile broadband D2D, multi-hop and multioperator D2D communications.

Module 5: **Millimeter-wave Communications** *(09 Periods)*

Millimeter-wave Communications – spectrum regulations, deployment scenarios, beam-forming, physical layer techniques, interference and mobility management, Massive MIMO propagation channel models, Channel Estimation in Massive MIMO, Massive MIMO with Imperfect CSI, Multi-Cell Massive MIMO, Pilot Contamination, Spatial Modulation (SM).

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXPERIMENTS:

1. Report on 5G Wireless Communication and its applications

2. Report on 5G and AI technologies

RESOURCES

TEXT BOOKS:

1. Martin Sauter "From GSM From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile

Networks and Mobile Broadband", Wiley-Blackwell.

2. Afif Osseiran, Jose. F. Monserrat, Patrick Marsch, "Fundamentals of 5G Mobile Networks" ,

Cambridge University Press

REFERENCE BOOKS:

Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", John Wiley & Sons.

2. Amitabha Ghosh and Rapeepat Ratasuk "Essentials of LTE and LTE-A", Cambridge University

Press

3. Athanasios G.Kanatos, Konstantina S.Nikita, Panagiotis Mathiopoulos, "New Directions in

Wireless Communication Systems from Mobile to 5G", CRC Press

4. Theodore S. Rappaport, Robert W. Heath, Robert C. Danials, James N. Murdock "Millimeter Wave Wireless Communications", Prentice Hall Communications

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=_bDatJxhfkQ

2. https://www.youtube.com/watch?v=9iMhc2OU-go

3. https://www.youtube.com/watch?v=sQTrPIwtWaw

WEB RESOURCES:

1. https://blog.ipleaders.in/medical-laws-conflict-ethic

2. https://www.gponline.com/medico-legal-importance-good-records/article/89

3. https://openmd.com/guide/medical-terminology

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22DS101013	**Generative AI**	3	-	-	-	3

Pre-Requisite   Python Programming

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course provides aevolution of generative models, starting from restricted Boltzmann machines and deep belief networks, and progressing to more advanced techniques such as Variational Auto encoders (VAEs), Generative Adversarial Networks (GANs), Long Short-Term Memory (LSTM) networks, and Transformer models.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO6. Demonstrate fundamentals of generative AI, including the principles and concepts behind generative models.

CO7. Use generative models, such as Variational Auto encoders (VAEs), Generative Adversarial Networks (GANs), Long Short-Term Memory (LSTM) networks, and Transformer models, using Tensor Flow 2.

CO8. Apply knowledge of generative AI to create realistic and creative images, generate text, and compose music using the implemented models.

CO9. Design use cases to explore the latest research and advancements in the field of generative AI, as well as discover a wide range of exciting and practical use cases for deep generative models.

CO10 Create and implement their own generative AI models, allowing them to explore and experiment with new ideas and applications.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3										3		
CO2	3		3											3		
CO3	3	3												3		
CO4	3													3		
CO5	3													3		
Course Correlation Mapping	3	3	3	3										3		

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO GENERATIVE AI   *(09 Periods)*

Applications of AI , Discriminative and generative models, Implementing generative models; The rules of probability- Discriminative and generative modeling and Bayes 'theorem; Uses of Generative Models- The promise of deep learning, Building a better digital classifier, Generating images; Style transfer and image transformation- Fake news and chatbots, Sound composition, The rules of the game; Unique challenges of Generative models;

Tensor flow and Kubeflow Deep neural network development and Tensor Flow; VSCode; Docker: A lightweight virtualization solution- Important Docker commands and syntax, Connecting Docker containers with docker-compose; Kubernetes :Robust management of multi-container applications- Important Kubernetes commands, Kustomize for configuration management; Kubeflow- Running Kubeflow locally with MiniKF, Installing Kubeflow in AWS, GCP, Azure, Terraform, Kubeflow's components- Kubeflow notebook servers, Kubeflow pipelines; Using Kubeflow Katib to optimize model hyperparameters

**Module 2:   BUILDING   BLOCKS   OF   DEEP   NEURAL   *(09 Periods)*
NETWORKS**

Perceptron's- a brain in a function- From tissues to TLUs, From TLUs to tuning perceptrons;Multi-layer perceptron's and back propagation- Back propagation in practice, The shortfalls of back propagation; Varieties of networks: Convolution and recursive- Networks for seeing: Convolutional architectures, Early CNNs, Alex Net and other CNN innovations, Alex Net architecture; Networks for sequence data- RNNs and LSTMs; Building a better optimizer- Gradient descent to ADAM, Xavier initialization;

Teaching Networks to Generate Digits-

The MNIST database- Retrieving and loading the MNIST dataset in Tensor Flow; Restricted Boltzmann Machines: generating pixels with statistical mechanics- Hopfield networks and energy equations for neural networks, Modeling data with uncertainty with Restricted Boltzmann Machines, Contrastive divergence: Approximating a gradient; Stacking Restricted Boltzmann Machines to generate images: the Deep Belief Network, Creating an RBM using the Tensor Flow Keras layers API, Creating a DBN with the Keras Model API

Module 3:   Neural Networks Using VAEs   *(09 Periods)*

Creating   separable   encodings   of   images;   The   variational   objective-The reparameterization trick; Inverse Autoregressive Flow; Importing CIFAR; Creating the network from TensorFlow2.

Image Generation with GANs-

The   taxonomy   of   generative   models;   Generative   adversarial   networks-The discriminator model, The discriminator model, Training GANs, Non-saturating generator cost and Maximum likelihood game; Vanilla GAN; Improved GANs- Deep Convolutional GAN, Vector arithmetic, Conditional GAN, Wasserstein GAN; Progressive GAN- The overall method, Progressive growth –smooth fade-in, Minibatch standard deviation, Equalized learning rate, Pixel wise normalization, Tensor Flow Hub implementation; Challenges-Training instability, Mode collapse, Uninformative loss

and evaluation metrics.

Module 4:   Rise of Methods for Text Generation   *(09 Periods)*

Representing text- Bag of Words, Distributed representation-Word2vec, GloVe, FastText; Text generation and the magic of LSTMs-Language modeling, Hands-on: Character-level language model; Decoding strategies- Greedy decoding, Beam search, Sampling, Hands-on: Decoding strategies; LSTM variants and convolutions for text-Stacked LSTMs, Bidirectional LSTMs, Convolutions and text;

NLP 2.0: Using Transformers to Generate Text:

Attention, Contextual embeddings, Self-attention, Transformers-Overall architecture, Multi-head self-attention, Positional encodings, BERT-ology; GPT 1, 2, 3- Generative pre-training: GPT, Hands-on with GPT-2, Mammoth GPT-3.

Composing Music with Generative Models:

Getting started with music generation-Representing music, Music generation using LSTM's- Dataset preparation, LSTM model for music generation; Music generation using GANs- Generator network, Discriminator network, Training and results; MuseGAN-polyphonic music generation- Jamming model, Composer model, Hybrid model, Temporal model, MuseGAN-Generators, Critic, Training and results.

Module 5:   Play Video Games with Generative AI: GAIL   *(09 Periods)*

Reinforcement learning:Actions,agents,spaces,policies, and rewards-Deep Q-learning, Inverse reinforcement learning: Learning from experts, Adversarial learning and imitation, Running GAIL on PyBullet Gym, The agent: Actor-Critic network, The discriminator, Training and results

Emerging Applications in Generative AI:

Introduction, Finding new drugs with generative models- Searching chemical space with generative molecular graph networks, Folding proteins with generative models; Solving partial differential equations with generative modeling; Few shot learning for creating videos from images; Generating recipes with deep learning

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXPERIMENTS:

1. Demonstration of Variational Auto encoder (VAE) using Tensor Flow 2 and Python. Generate new images using the trained VAE and observe the results

1. Demonstration of Long Short-Term Memory (LSTM) model using Tensor Flow 2 and Python.Generate new text samples using the trained LSTM model and analyze the output.

2. Observation and understanding music samples, such as MIDI files. Generate new music compositions using the trained GAN and evaluate the results.

3. Demonstration of GAN architectures, loss functions, and training strategies.

4. Demonstration of working new text samples using the trained Transformer model and analyze the output. Explore techniques like fine-tuning pre-trained Transformer models or using different attention mechanisms.

RESOURCES

TEXT BOOKS:

1. Joseph Babcock, Raghav Bali, Generative AI with Python and TensorFlow, Packt Publishing, 2021.

2. Numa Dhamani and Maggie EnglerIntroduction to Generative AI, Manning Publisher, 2024.

REFERENCE BOOKS:

1. Chris Frgly, Antje Barth, Shelbee Eigenbrode, Generative AI on AWS, O'Reilly Media, Inc., 2023.
2. Bernard Marr ,Generative AI in Practice, Wiley, 2023.

VIDEO LECTURES:

1. https://youtu.be/6okwxO_iW7M?si=O460e6hznFobu3cV

2. https://youtu.be/AALBGpLbj6Q?si=rKKFgi28nBSzNmes

3. https://youtu.be/MZmNxvLDdV0?si=avwKtCQ9FmFTtVQW

WEB RESOURCES:

1. https://www Generative AI with Python and TensorFlow 2 (oreilly.com)

2. Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs, GANs, LSTMs, Transformer models | Packt Publishing books | IEEE Xplore

3. GitHub - PacktPublishing/Hands-On-Generative-AI-with-Python-and-TensorFlow-2: Hands-On Generative AI with Python and TensorFlow 2, published by Packt

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22DS101014	**Explainable AI**	3	-	-	-	3

Pre-Requisite -**Machine Learning**

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Introduction to AI, Explainability for Tabular Data, Image Data,Text Data,Advanced and Emerging Topics in Explainability Techniques and Approaches,Interacting with Explainable AI its structure and case studies.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO11 Understand what Explainable AI is,its fundamental concepts and limitations of Explainable AI (XAI), its scope, and impact on various domains.

CO12 Use DifferentXAI methodologies for extraction of knowledge and problem solving.

CO13 Apply advanced tools and techniques to select and assess Explainable AI methods on Image data.

CO14 Design the review, present and critically assess state-of-the-art papers in relevant text data within Explainable AI

CO15 Discuss the ethical and societal implications of XAI development and deployment.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3			3										3		
CO2	3	2		2										3		
CO3	3		3											3		
CO4	3	2												3		
CO5	3													3		
Course Correlation Mapping	**3**	**2**	**3**	**3**										**3**		

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1:   INTRODUCTION   *(09 Periods)*

Need of Explainable AI, Challenges in Explainability, Evaluating Explainability, Explainable AI in Linkedin, Auto Insurance Claims, Loan Decisions, "Third-Wave AI", Explainability Consumers- Practitioners—Data Scientists and ML Engineers, Observers—Business Stakeholders and Regulators, End Users—Domain Experts and Affected Users. Types of Explanations-PremodelingExplainability,Intrinsic Versus Post Hoc Explainability, Local, Cohort, and Global Explanations, Attributions, Counterfactual, and Example-Based Explanations; Themes Throughout Explainability, Feature Attributions, Surrogate Models, Activation

Module 2:   EXPLAINABILITY FOR TABULAR DATA   *(09 Periods)*

Permutation Feature Importance- Permutation Feature Importance from Scratch, Permutation Feature Importance in scikit-learn; Shapley Values- SHAP (SHapley Additive exPlanations), Visualizing Local Feature Attributions, Visualizing Global Feature Attributions, Interpreting Feature Attributions from Shapley Values, Managed Shapley Values; Explaining Tree-Based Models- From Decision Trees to Tree Ensembles, SHAP's TreeExplainer; Partial Dependence Plots and Related Plots- Partial Dependence Plots (PDPs), Individual Conditional Expectation Plots (ICEs), Accumulated Local Effects (ALE).

Module 3:   EXPLAINABILITY FOR IMAGE DATA   *(09 Periods)*

Integrated Gradients (IG)- Choosing a Baseline, Accumulating Gradients, Improvements on Integrated Gradients; XRAI- How XRAI Works, Implementing XRAI; Grad-CAM- How Grad-CAM Works, Implementing Grad-CAM, Improving Grad-CAM; LIME- How LIME Works, Implementing LIME; Guided Backpropagation and Guided Grad-CAM- Guided Backprop and DeConvNets, Guided Grad-CAM.

Module 4:   EXPLAINABILITY FOR TEXT DATA   *(09 Periods)*

Overview of Building Models with Text- Tokenization, Word Embeddings and Pretrained Embeddings; LIME- How LIME Works with Text; Gradient x Input- Intuition from Linear Models, From Linear to Nonlinear and Text Models, Grad L2-norm; Layer Integrated Gradients- A Variation on Integrated Gradients; Layer-Wise Relevance Propagation (LRP)- How LRP Works, Deriving Explanations from Attention; Language Interpretability Tool.

Advanced and Emerging Topics: Alternative Explainability Techniques- Alternate Input Attribution, Explainability by Design; Other Modalities- Time-Series Data, Multimodal Data; Evaluation of Explainability Techniques- A Theoretical Approach, Empirical Approaches.

Module 5:   INTERACTING WITH EXPLAINABLE AI   *(09 Periods)*

Interacting with Explainable AI- Effectively Present Explanations, Clarify What, How, and Why the ML Performed the Way It Did, Accurately Represent the Explanations, Buildon the ML Consumer's Existing Understanding; Common Pitfalls in Using Explainability-Assuming Causality, Overfitting Intent to a Model, Overreaching for Additional Explanations.

Build with Explainability:

Look Forward to in Explainable AI, Natural and Semantic Explanations, Interrogative Explanations, Targeted Explanations

Case Studies: Explainable AI for stock price prediction in stock market, Advancements of XAI in healthcare sector, Adequate lung cancer prognosis system using data mining algorithms, Comparison of artificial intelligence models for prognosis of breast cancer, AI-powered virtual therapist: for enhanced human-machine interaction.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXPERIMENTS:

1. Demonstration of Explainable AIin various domains

2. Demonstration of Tabular data using decision treesand plots

3. Demonstration of Image data using LIME and CAM

4. Demonstration of Alternative Explainability Techniques on Time-Series Data, Multimodal Data

5. Observation of the Common Pitfalls and explanation in various domains.

RESOURCES

TEXT BOOKS:

1. Michael Munn, David Pitman, Explainable AI for Practitioners, O'Reilly Media, Inc., 2022.

2. Pethuru Raj, Utku Kose, and Usha Sakthivel, Explainable artificial intelligence (XAI): concepts, enabling tools, technologies and applications, Computing and networks, IET.

REFERENCE BOOKS:

Denis Rothman. Hands-On Explainable AI (XAI) with Python. Packt 2020.

2. Escalante, H. J., Escalera, S., Guyon, I., Baro, X., Gucluturk, Y., Guclu, U., & van Gerven, M. A. J. (Eds.). (2018). Explainable and Interpretable Models in Computer Vision and Machine Learning. Springer

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=YuDijSIR9iM

2. https://www.youtube.com/playlist?list=PLqDyyww9y-1SwNZ-6CmvfXDAOdLS7yUQ4

3. https://xai.arya.ai/resource/explainableai-workshop

WEB RESOURCES:

1. https://hcixaitutorial.github.io/

2. https://christophm.github.io/interpretable-ml-book/scope-of-interpretability.html

3. https://www.darpa.mil/program/explainable-artificial-intelligence

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CS101006	**HIGH PERFORMANCE COMPUTING**	3	-	-	-	3

Pre-Requisite

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course focuses on the fundamental principles and models underlying all aspects of distributed computing. It includes topics that covers the principles underlying the theory, algorithms, and systems aspects of distributed computing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1   To Study various computing technology architecture.
CO2   To know Emerging trends in computing technology.
CO3   To highlight the advantage of deploying computing technology.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	3	-	-	-	-	2	-	-	-	-	-	3	-	3
CO3	3	3	3	-	-	-	-	-	-	-	2	-	3	-	3
Course Correlation Mapping	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**2**	**-**	**3**	**-**	**3**

Correlation Levels: 3: High;   2: Medium;1: Low

COURSE CONTENT

Module 1 – Cluster Computing and its Architecture: **(09 Periods)**
Ease of Computing, Scalable Parallel Computer Architecture, Towards Low Cost Parallel Computing & Motivation, Windows opportunity, A Cluster Computer And Its Architecture,Cluster Classification, Commodity Components for Clusters, Network Services/Communication SW, Cluster Middleware and Single Systems Image, Resource management & Scheduling (RMS)

Module 2 - Cluster Setup and Administration: **(08 Periods)**
Introduction, Setting up the cluster, Security, System Monitoring, System Tuning

Module 3 - Introduction to Grid and its Evolution: **(10 Periods)**
Introduction to Grid and its Evolution, Beginning of the Grid, Building blocks of Grid, Grid Application and Grid Middleware, Evolution of the Grid: First, Second & Third Generation

Module 4 - Introduction to Cloud Computing: **(09 Periods)**
Defining Clouds, Cloud Providers, Consuming Cloud Services, Cloud Models – Iaas, Paas, SaaS, Inside the cloud, Administering cloud services, Technical interface, Cloud resources

Module 5 - Nature of Cloud: **(09 Periods)**
Tradition Data Center, Cost of Cloud Data Center, Scaling computer systems, Cloud work load, Managing data on clouds, Public, private and hybrid clouds

Total Periods: 45

EXPERIENTIAL LEARNING

1 To study the basic commands of linux.
2 To establish Beowulf Cluster using MPI(Message Passing Interface) Library.
3 Installation and configuration of Alchemi Grid.
4 Running a sample application on Alchemi Grid and analysing it.
5 To study a Grid Simulation Toolkit.
6 To run two sample programs using GridSim Toolkit.
7 To study a Cloud Simulation Toolkit.
8 To setup Cloud.

SOFTWARE/TOOLS:

1 Linux Programming

.

Text Book

1. High Performance Cluster Computing, Volume 1, Architecture and Systems, Rajkumar Buyya, Pearson Education.
2. Berman, Fox and Hey, Grid Computing – Making the Global Infrastructure a Reality, Wiley India.
3. Hurwitz, Bllor, Kaufman, Halper, Cloud Computing for Dummies, Wiley, India.

Reference Books

1. Ronald Krutz, Cloud Security, Wiley India.
2. Cloud Computing, A Practical Approach, Anthony Velte, Toby Velte, Robert Elsenpeter, McGrawHill..

VIDEO LECTURES:

1. https://anandgharu.wordpress.com/be/
2. http://www.digimat.in/nptel/courses/video/106108055/L01.html
3. https://omscs.gatech.edu/cse-6220-intro-high-performance-computing-course-videos

WEB RESOURCES:

1. **https://www.cse.iitd.ac.in/~dheerajb/hpc.htm**
2. https://www.iitg.ac.in/asahu/cs528-2023/

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22IT102003	**CLOUD COMPUTING**	3	-	2	-	4
Pre-Requisite	- Object Oriented Programming through Java, Operating Systems					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion onFundamental Cloud Computing and Virtualization, Understanding Cloud Models and Architectures, Understanding Cloud Services, Applications and Capacity Planning, Exploring Platform as a Service (PaaS) and Exploring Infrastructure as a Service (IaaS).

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

CO1. Demonstrate knowledge on basic concepts and terminologies of Cloud Computing and Virtualization.

CO2. Demonstrate knowledge on Cloud deployment models, Service models and Architectures.

CO3. Analyze Cloud services, Applications and Capacity Planning.

CO4. Use different PaaS application frameworks to construct Cloud applications.

CO5. Develop web applications through Google, Microsoft and Amazon web services as per societal needs.

CO6. Work independently or in teams to construct Cloud applications and present with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	2	3	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	2	3	-
CO3	3	3	3	2	2	-	-	-	-	-	-	-	3	2	3	-
CO4	3	3	3	2	2	-	-	-	-	-	-	-	2	2	3	-
CO5	3	2	2	2	2	3	-	-	-	-	-	-	2	2	3	-
CO6				2					3	3						
Course Correlation Mapping	3	3	3	2	2				3	3			3	2	3	

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT:
Module-1: FUNDAMENTAL CLOUD COMPUTING AND VIRTUALIZATION (10 periods)

Cloud Computing: Origin and influences, Basic concepts and terminology, Goals and benefits, Risks and challenges, Roles and boundaries and Cloud characteristics.

Introduction to Virtualization: Characteristics, Taxonomy of virtualization technologies, Pros and cons of virtualization, Virtualization Technologies:Xen**,** VMware and Hyper-V.

Module-2: UNDERSTANDINGCLOUD MODELS AND ARCHITECTURES   (8 periods)

Cloud Models: NIST model, Cloud Cube model, Deployment models: Public, Private, Hybrid and Community; Service models: IaaS, PaaS and SaaS.

Understanding Cloud Architecture: Exploring the Cloud Computing Stack: Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications; Connecting to the Cloud: The Jolicloud Netbook OS and Chromium OS - The Browser as an Operating System.

Module-3: UNDERSTANDING CLOUD SERVICES, APPLICATIONS AND CAPACITY PLANNING (9 periods)

Understanding Cloud Services and Applications Infrastructure as a Service (IaaS): IaaS workloads, Pods, aggregation, and silos; Platform as a Service (PaaS), Software as a Service (SaaS): SaaS characteristics, Open SaaS and SOA, Salesforce.com and CRM SaaS; Identity as a Service (IDaaS): Identity, Networked identity service classes, Identity system codes of conduct, IDaaS interoperability; Compliance as a Service (CaaS).

CapacityPlanning: Defining Baseline and Metrics: Baseline measurements, System metrics, Load Testing, Resource ceilings, Server and instance types; Network Capacity and Scaling.

Module-4: EXPLORING PLATFORM AS A SERVICE (PaaS) (10 periods)

PaaS Application Frameworks: Drupal, Eccentex AppBase 3.0, LongJump, Squarespace, WaveMaker and Wolf Frameworks.

Exploring Platform as a Service using Google Web Services: Surveying the Google Application Portfolio, Google Toolkit and Working with the Google App Engine.

Exploring Platform as a Service using Microsoft Cloud Services: Exploring Microsoft Cloud Services, Defining the Windows Azure Platform, Windows Live: Windows Live Essentials, Windows Live Home and Windows Live for Mobile.

Module-5: EXPLORING INFRASTRUCTURE AS A SERVICE (IaaS) (8 periods)

Understanding Amazon Web Services, Amazon Web Service Components and Services, Working with the Elastic Compute Cloud (EC2): Amazon Machine Images, Pricing models, System images and software, Creating an account and instance on EC2; Working with Amazon Storage Systems: Amazon Simple Storage System (S3), Amazon Elastic Block Store (EBS) and CloudFront; Understanding Amazon Database Services: Amazon SimpleDB, Amazon Relational Database Service (RDS) and Choosing a database for AWS.

Total Periods: 45

EXPERENTIAL LEARNING

List of Exercises:
1. Create a Virtual Machine on Virtual Box with Ubuntu 14LTs files, 2GB RAM and 200GB Hard Disk configuration through Infrastructure as a Service (IaaS).
2. Create a Virtual Machine on Virtual PC with Windows, 2GB RAM and 200GB Hard Disk configuration through Infrastructure as a Service (IaaS).
3. Create Virtual Private Cloud (VPC) with subnets, route table and Internet gateway using AWS Management Console.
4. Create a virtual machine instance with 2GB RAM and 200 GB hard disk configuration on Amazon Web Services (AWS) cloud through Elastic Compute Cloud (EC2) service and develop a home web page for online bookstore information.
5. Develop a catalogue web page for online bookstore and create a Simple Storage Service (S3) bucket on Amazon Web Services (AWS) cloud and upload catalogue web page into S3 bucket.
6. Compute the following tasks through AWS Lambda function in an event-driven environment using Qwiklabs Cloud:
    i. Create an AWS Lambda function
    ii. Configure an Amazon S3 bucket as a Lambda Event Source
    iii. Trigger a Lambda function by uploading an object to Amazon S3
    iv. Monitor AWS Lambda S3 functions through Amazon CloudWatch Log.
7. Compute the following tasks through Amazon DynamoDB using Qwiklabs Cloud:
    i. Create an Amazon DynamoDB table
    ii. Enter data into an Amazon DynamoDB table
    iii. Query an Amazon DynamoDB table
    iv. Delete an Amazon DynamoDB table.
8. (a) Perform the following operations through Google Cloud Pub/Sub using Qwiklabs Cloud:
    i. Setup a topic to hold data
    ii. Subscribe to a topic to access the data
    iii. Publish and then consume messages with a pull subscriber.

(b) Create an Google Assistant environment through Actions and Dialogflow for building an Assistant application that generates quotes when prompted by a user using Qwiklabs Cloud.

9. (a) Implement a Python Program using Watson studio in IBM Cloud Environment

(b) Deploy and Run any application in IBM Cloud Environment

(c) Develop a chat bot using Watson Assistant in IBM Cloud Environment.

10. (a) Create two data centers in different regions with 10-20 physical host, 6-10 userbases, 100-250 executable instructions length per request using Cloud Analyst simulation tool.

(b) Evaluate and generate reports for 10(a) with different Service Broker and Load Balancing Policies. Sketch out the comparison report on different policies.

11. Create an instance for connecting, monitoring and visualizing Internet of Things (IoT) device data through Thingspeak cloud.

12. Mini Project: Form a group of maximum 3 members as a team and assign unique projects for each team.

RESOURCES
TEXT BOOKS:
1. Barrie Sosinsky, *Cloud Computing Bible,* Wiley India Pvt Ltd, 2011 (Reprint 2017).
2. Thomas Erl and RicardoPuttini, *Cloud Computing- Concepts, Technology and Architecture,* Pearson, 2014 (Seventh Impression 2017).

REFERENCE BOOKS:
1. Rajkumar Buyya, Christian Vecchiloa and S Thamarai Selvi, *Mastering Cloud Computing*, McGraw Hill Education, 2013 (Reprint 2017).
2. George Reese, *Cloud Application and Architectures*, O'Relly, 2009 (Reprint 2017).

WEB RESOURCES:
1. "Exploring the Google Toolkit", https://code.google.com/, drafted on 23 December, 2019.
2. "Understanding Amazon Web Services", https://aws.amazon.com/, drafted on 23 December, 2019.
3. "Exploring Microsoft Cloud Services", https://www.microsoft.com/windowsazure, drafted on 23 December, 2019.
4. "Qwiklabs – Hands-on Cloud Environment", https://www.qwiklabs.com/, drafted on 23 December, 2019.
5. "IBM Cloud Envrionment", https://www.ibm.com/in-en/cloud, drafted on 23 December, 2019.
6. "Cloud Analytics Simulation Tool", http://www.cloudbus.org/cloudsim/, drafted on 23 December, 2019.
7. "Thingspeak Cloud", https://thingspeak.com/, drafted on 23 December, 2019.

SOFTWARE/TOOLS:
1. Virtual Box and Virtual PC Software
2. Cloud Analyst Simulation Tool
3. Amazon Web Services (AWS), Qwiklabs, IBM Bluemix and Thingspeak Cloud

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101002	**MOBILE COMPUTING**	3	-		-	3

Pre-Requisite Computer Networks
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion onOverview of Mobile computing and Second-Generation Architecture; Wireless Medium Access Control, CDMA, 3G, WIMAX, 4G and 5G Networks; Mobile IP Network Layer; Mobile Transport Layer; Wireless LAN and Personal Area Network Protocols.

COURSE OUTCOMES: *After successful completion of the course, students will be able to*:
CO1. Understand the basics mobile computing and second-generation architectures.
CO2. Demonstrate knowledge on Wireless Medium Access Control, CDMA, 3G, WiMax, 4G And 5G Networks.
CO3. Understand the Network protocols and their functionality.
CO4. Understand the functionality of Transport Layer.
CO5. Demonstrate knowledge on wireless LAN and Personal Area Network protocols

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	3	**-**	**-**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT
**Module 1:   OVERVIEW OF MOBILE COMPUTING AND SECOND-   (10 periods)
               GENERATION ARCHITECTURE**

Mobile Computing Architecture: An Overview: Mobile Computing, Mobile Computing Operating System, Mobile Computing Architecture, Design Considerations for Mobile Computing, Mobile Computing and the Apps, Limitations of Mobile Devices, Security Issues Second-generation Architecture-GSM, GPRS, and Others: GSM Services, GSM System Architecture, Space Division Multiple Access, Time Division Multiple Access, and Frequency Division Multiple Access, Call Routing, Public Land Mobile Network (PLMN) Interface, GSM Subscriber Addresses and Identities, Protocols, Localization, Call Handling, Handover, Security, Introduction to SMS, General Packet Radio Service, High-speed Circuit-switched Data, Digital Enhanced Cordless Telecommunications, WLL Application

**Module 2:   WIRELESS MEDIUM ACCESS CONTROL, CDMA, 3G,   (10 periods)
               WIMAX, 4G AND 5G NETWORKS**

Modulation, Medium Access Control, Exposed and Hidden Terminal Problem, Near and Far Terminal Problem, and Power Control for Medium Access, MAC Algorithms, WLAN and CAMA/CA Wireless Protocols, SDMA, TDMA, FDMA and CDMA, Direct Sequence Spread Spectrum, Frequency Hopping Spread Spectrum, Code Division Multiple Access

3G: Applications of 3G Mobile Services, 3G Mobile Services: IMT2000 and UMTs, CDMA 2000: 3G, WCDMA 3G, OFDM, High-speed Packet Access, Mimo in HSPA, Long-term Evolution and WiMax 16E, Ultra-wide Band and Broadband Wireless Access
4G Networks: HS-OFDM, LTE Advanced and WiMax 16M, Upcoming 5G Network Features

Module 3:   MOBILE IP NETWORK LAYER   (9 periods)
Functioning of OSI Layers, and TCP/IP, IP, UDP and ICMP Protocols, Mobile IP, Packet Delivery and Handover Management, Location Management, Registration, IP Header: Encapsulation and Routes Optimization, Mobility Binding, Tunneling, and Reverse Tunneling, Dynamic Host Configuration Protocol, Cellular IP, Mobile IP with IPv6, Voice over IP, IP Security.

Module 4:   MOBILE TRANSPORT LAYER   *(8 Periods)*

Conventional Transport Layer Protocols: UDP and TCP, Indirect TCP, Snooping Transmission Control Protocol, Mobile TCP, Other Transmission Methods at TCP Layer for Mobile Networks, TCP over 2.5G/3G Mobile Networks

Module 5:   WIRELESS LAN AND PERSONAL AREA NETWORK   *(8 Periods)*
**   PROTOCOLS**
Wireless LANs, Wireless Application Protocol, Wireless Markup Language, Bluetooth, WiMax, ZigBee and Wi-Fi, Bluetooth, and ZigBee Features

Total Periods: 45

EXPERIENTIAL LEARNING:
1.   What are the differences between the previous generations of mobile networks and 5G?
2.   How fast is 5G? What is its impact on mobile computing?
3.   How does 5G Technology works?

RESOURCES

TEXT BOOKS:
1.   Rajkamal, *Mobile Computing,* OXFORD University Press, 3rdEdition, 2019.

REFERENCE BOOKS:
1.   Jochen Schiller*, Mobile Communications,*Pearson Education, 2ndEdition, 2009

VIDEO LECTURES:

https://onlinecourses-archive.nptel.ac.in/noc16_cs13/preview

WEB RESOURCES:

1. https://www.javatpoint.com/mobile-computing
2. https://www.geeksforgeeks.org/wireless-mobile-computing-technologies
3. https://dataconomy.com/2022/07/29/what-is-mobile-computing

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB102006	**INTERNET OF THINGS**	3	-	2	-	4

Pre-Requisite   - Computer Networks
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion onInternet of Things Components; Domain Applications; Communication models; Sensors; Connectivity; Prototyping; Hardware; Design Methodology; Development platforms; Data Analytics for IoT; IoT Security..

COURSE OUTCOMES: *After successful completion of the course, students will be able to*:
CO1. Understand IoT Architectures , communication technologies and various applications of IoT
CO2. Demonstrate knowledge on IoT-related protocols and Smart Objects
CO3. Understand hardware platforms and cloud services related to IoT
CO4. Build IoT applications using Arduino and Raspberry Pi
CO5. Understand data analytics concepts and security issues in the context of IoT
CO6. Work independently and in teams to develop IoT applications with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	2	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	3	2	2	-
CO4	3	2	3	2	3	-	-	-	-	-	-	-	3	2	2	3
CO5	3	2	2	3	-	-	-	-	-	-	-	-	3	2	2	3
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	3	2	2	3

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT

Module 1: INTRODUCTION & DOMAIN APPLICATIONS   *(09 Periods)*
Introduction to Internet of Things:
Definition, Conceptual Framework, Architectural View, Technology behind IoT, Communication Technologies, Data Enrichment, Data consolidation and Device management at Gateway.
IoT and M2M: M2M, Difference between IoT and M2M, SDN and NFV for IoT.
Domain Specific IoTs: Home automation, Cities, Environment, Health and Life Style.

Module 2: SENSORS & CONNECTIVITY   *(09 Periods)*
Sensor Technology, Actuators, RFID Technology, Internet Connectivity, Internet-Based Communications, IP Addressing in the IoT, Medium Access Control, Application Layer Protocols.

Module 3: PROTOTYPING & HARDWARE   *(8 Periods)*
Embedded Computing Basics, Embedded platforms for prototyping, Things always connected to the Internet/Cloud, Amazon Web Services for IoT.

Module 4:   DESIGN METHODOLOGY & CASE STUDIES   *(10 Periods)*

Design Methodology: Purpose and Requirements specifications, Process Specifications, Domain Model Specification, Information Model Specification, Service Specification, IoT Level Specifications, Functional View Specification, Operational View Specification, Device and Component integration, Application development.
Case Studies Illustrating IoT Design: Home Automation, Cities.

Module 5:   DATA ANALYTICS FOR IOT& IoT Security   *(9 Periods)*
Data Analytics for IoT: Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis.
IoT Security: Vulnerabilities, Security Requirements and Threat analysis, Security Tomography and Layered Attacker Model, Identity Management and Establishment, Access Control and Secure Message Communication, Security Models, Profiles and Protocols for IoT

                                                                    Total Periods: 45

EXPERIENTIAL LEARNING
1. (a) Design and Simulate LED 7-Segment Display interfacing with Arduino.
   (b) Design and Simulate Servo motor interfacing with Arduino.
2. (a) Design and Simulate ultrasonic sensor and LCD interfacing with Arduino.
   (b) Design and Simulate Flame Sensor interfacing with Arduino.
3. Design and Implement to capture Gas Sensor and send sensor data to cloud from your NodeMCU device using Arduino IDE.
4. Design and Implementation of Humidity and Temperature Monitoring Using Arduino and upload data to cloud using MQTT.
5. Design and Implementation of an IoT ECG (Electrocardiogram) System to record hearts electrical activity.
6. Design and Simulate controlling an LED 7-Segment Display with Raspberry Pi.
7. Design and implementation of Raspberry Pi Home Security System with Camera and PIR Sensor with Email Notifications.
8. Design and Implement to upload Light sensor (TSL) data to cloud through Raspberry Pi.
9. Design and Implementation of Motion Detector with NodeMCU and BLYNK.
10. Design and Implementation of Fire notification IoT system with BLYNK.

RESOURCES:
TEXT BOOKS:
1. ArshdeepBahga, Vijay Madisetti, *Internet of Things – A hands-on approach*, University Press, 2015.
2. Raj Kamal, *Internet of Things- Architecture and Design Principles*, McGraw Hill, 2017.
REFERENCE BOOKS:
1. Adrian McEwen and Hakim Cassimally, *Designing the Internet of Things*, Wiley Publishing, 2013.
2. CharlesBell, *Beginning Sensor Networks with Arduino and Raspberry Pi*, Apress, 2013.
3. Marco Schwartz, *Internet of Things with the Arduino Yun*, Packt Publishing, 2014.
4. Matt Richardson, Shawn Wallace, *Getting Started with Raspberry Pi*, Maker Media, Inc, 2012.
SOFTWARE/TOOLS:

- Arduino IDE

VIDEO LECTURES:

1. https://www.digikey.com/en/maker/projects/how-to-interface-a-seven-segment-display-with-an-arduino/9c05f147618c4fe3b8bb79acce5c60e3
2. https://www.engineersgarage.com/interfacing-servo-motor-with-arduino-mega-2560/
WEB RESOURCES:

1.   https://www.geeksforgeeks.org/top-applications-of-iot-in-the-world1.
2.   https://www.javatpoint.com/internet-of-things-applications

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CS101011	AD HOC AND WIRELESS SENSOR NETWORKS	3	-	-	-	3

Pre-Requisite	- Computer Networks
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: Ad hoc Wireless Networks, Medium Access Control Protocols for Ad hoc Wireless Networks, Routing Protocols for Ad hoc Wireless Networks, Wireless Sensor Networks, Medium Access Control Protocols for WSN's.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Investigate ad hoc and wireless sensor networks to improve the network performance.
CO2. Analyze the issues in MAC, routing protocols in Ad hoc wireless networks.
CO3. Apply routing protocols of MAC Layer in sensor networks to provide networking solutions.
CO4. Follow norms and standards in engineering practice to solve ad hoc and wireless sensor network problems.

CO-PO-PSO MappingTable:

Course Outcomes	ProgramOutcomes												ProgramSpecific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	-	3	-
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	-	3	-
CO4	2	3	3	-	-	2	-	-	-	-	-	-	3	-	3	-
CO5	2	2	3	-	2	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	3	-	2	2	-	-	-	-	-	-	3	-	3	-

CorrelationLevels: 3:High;   2: Medium;   1:Low

COURSE CONTENT:

Module-1: AD HOC WIRELESS NETWORKS   (8 periods)
Fundamentals of wireless communication technology, The electromagnetic spectrum, Radio propagation mechanisms, Characteristics of the wireless channel, Applications, Issues, Ad hoc wireless Internet.

Module-2: MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS   (8 periods)
Issues in designing a MAC protocol, Classification of MAC protocols, Contention based protocols, Contention based protocols with reservation mechanisms, Contention based protocols with scheduling mechanisms.

Module-3: ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS(9 periods)
Issues in designing routing and transport layer protocol for Ad hoc networks, Classification of routing protocols, Table driven routing protocols, On demand routing protocols, Hybrid routing protocols.

Module-4: WIRELESS SENSOR NETWORKS   (9 periods)
Vision of ambient intelligence, Application examples, Types of applications, Challenges of WSN's, Why are sensor networks different, Enabling technologies, Hardware

components, Energy consumption of sensor nodes.

Module-5: MEDIUM ACCESS CONTROL PROTOCOLS FOR WIRELESS SENSOR NETWORKS **(11 periods)**
Fundamentals of MAC protocols, Low duty cycle protocols and wake up concepts, Contention based protocols, Schedule based protocols, IEEE 802.15.4 MAC protocol, 802.11 and Bluetooth, Case study on tele healthcare – Introduction, MASN hardware design, Reliable MASN communication protocols, MASN software design, Integration of RFID and wearable sensors.

Total Periods: 45

RESOURCES

TEXT BOOKS:
1. C. Siva Ram Murthy, B.S. Manoj, *Ad Hoc Wireless Networks: Architectures and Protocols*, Pearson, 2012.
2. Holger Karl and Andreas Willig, *Protocols and Architectures for Wireless Sensor Networks*, Wiley, 2017.

REFERENCE BOOKS:
1. Fei Hu and Xiaojun Cao, *Wireless Sensor Networks: Principles and Practice*, CRC Press, 2010.
2. Yi Qian, Peter Muller and Hsiao–Hwa Chen, *Security in Wireless Networks and Systems*, Wiley, 2011.

VIDEO LECTURES:
1. https://archive.nptel.ac.in/courses/106/105/106105160/
2. https://www.youtube.com/watch?v=B0hJj31BYCo

WEB RESOURCES:

1. https://www.oldcitypublishing.com/journals/ahswn-home/
2. https://www.techtarget.com/searchmobilecomputing/definition/ad-hoc-network

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101018	**SEMANTIC WEB AND SOCIAL NETWORKS**	3	-	-	-	3

Pre-Requisite	Computer Networks and Web Technologies
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: Semantic web and social network analysis; web data & semantics in social network applications and knowledge representation; modeling, aggregating and social network data; developing social semantic applications; evaluation of web-based social network extraction and semantic- based network analysis in the science.

COURSE OUTCOMES: *After successful completion of this course, the students will be able to:*
CO1. Demonstrate Knowledge on semantic web and social networks.
CO2. Analyze Ontology tools and their role in the Semantic Web.
CO3. Apply Ontological representation for Social network applications.
CO4. Develop semantic web applications with social network features.
CO5. Apply different social network applications and knowledge representations in sciences.

CO-PO-PSO MappingTable:

Course Outcomes	ProgramOutcomes												ProgramSpecific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	-	3	-
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	-	3	-
CO4	2	3	3	-	-	2	-	-	-	-	-	-	3	-	3	-
CO5	2	2	3	-	2	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	3	-	2	2	-	-	-	-	-	-	3	-	3	-

CorrelationLevels: 3:High;   2: Medium;   1:Low

DETAILED SYLLABUS:

Module-1: SEMANTIC WEB AND SOCIAL NETWORK ANALYSIS   (8 Periods)

Introduction of Semantic Web, Limitations of the current Web, Development of semantic Web-Research, development and standardization, Technology adoption, The emergence of semantic web, network analysis, development of Social Network Analysis .Key concepts and measures in network analysis-The global structure of networks, the macro structure of social networks.

**Module-2:   SOCIAL NETWORK APPLICATIONS AND KNOWLEDGE   (10 Periods)
REPRESENTATION**

Electronic sources for network analysis- Electronic discussion networks, Blogs and online communities , Web-based networks, Ontology and their role in the Semantic Web - Ontology-based knowledge Representation, Ontology languages for the Semantic Web-Resource Description Frame work and schema, Web Ontology Language ,comparison to the Unified modeling language, comparison to the Entity/ Relationship(E/R) model and the relational model, comparison to the Extensible Markup Language(XML) and XML schema.

Module-3: MODELING AND AGGREGATING SOCIAL NETWORK DATA **(9 Periods)**

State-of-the-art in network data representation, Ontological representation of social individuals , Ontological representation of social relationships , Aggregating and reasoning with social network data- Representing identity, On the nation of equality, Determining equality, Reasoning with instance equality ,Evaluating smushing, Advanced representations.

Module-4: DEVELOPING SOCIAL SEMANTIC APPLICATIONS **(9 Periods)**

Building semantic Web applications with social network features- The generic architecture of semantic Web applications, Sesame, Elmo, GraphUtil. Flink- The social networks of the Semantic Web Community, The feature of Flink, system design, openacademia- distributed, semantic-based publication management- The features of openacademia, system design.

Module-5: EVALUATION OF WEB-BASED SOCIAL NETWORK EXTRACTION AND ANALYSIS IN THE SCIENCES **(9 Periods)**

Differences between survey methods and electronic data extraction, context of the empirical study, Data collection, preparing the data ,Optimizing goodness of fit ,Comparison across methods and networks, Predicting the goodness fit, Evaluation through analysis ,Methodology- Data acquisition, Representation, storage and reasoning, Visualization and analysis. Results- Descriptive analysis, Structural and cognitive effects on scientific performance.

Total Periods: 45

RESOURCES

TEXT BOOK:
1.   Peter Mika, *Social Networks and the Semantic Web*, Springer, 1stEdition, 2007.

REFERENCE BOOK:
1.   Charu C. Aggarwal, *Social Network Data Analytics*, Springer, 2011.

VIDEO LECTURES:
- https://www.youtube.com/watch?v=InL9bo-vKXs
- https://www.youtube.com/watch?v=V6BR9DrmUQA

WEB RESOURCES:

1. https://groups.google.com/g/bvritcseb2015/c/gQ9cInAJtyk?pli=1

2. https://www.emerald.com/insight/content/doi/10.1108/09696470510611384/full/html?skipTracking=true

PROGRAMELECTIVE

CourseCode	Course Title	L	T	P	S	C
22AI101017	**DATA MINING**	3	-	-	-	3

Pre-Requisite Database Management Systems

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course emphasizes on the fundamental concepts of Data Mining. The course also covers concepts such as Data Pre-processing, Operational Database Systems and Data Warehouses, Mining Frequent Patterns, Classification and Prediction, Clustering, Data warehousing and Mining tools. The course also focuses on New Trends and Research Frontiers andVisualization of Multi-Dimensional Data.

COURSEOUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply data pre-processing techniques to produce refined data.

CO2. Apply Association rules and classification techniques for data categorization.

CO3. Use clustering techniques for grouping similar data items and identify outliers.

CO4. Understand Data Mining trends and applications.

CO5. Implement Visualization of Multi-dimensional Data

CO-PO-PSOMappingTable:

Course Outcomes	ProgramOutcomes												ProgramSpecific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	-	-	-
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	-	-	-
CO4	2	3	3	-	-	2	-	-	-	-	-	-	3	-	-	-
CO5	2	2	3	-	2	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	3	-	2	2	-	-	-	-	-	-	3	-	-	-

CorrelationLevels: 3: High;   2: Medium;   1:Low

COURSE CONTENT

Module 1   DATA MINING AND DATA PREPROCESSING   *(08 Periods)*
Introduction to Data Mining, kinds of data, kinds of patterns, major issues in Data Mining, Data Pre-processing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Discretization.

Module 2   ASSOCIATIONS AND CLASSIFICATION   *(10 Periods)*
Basic Concepts, Frequent itemset Mining Methods, pattern evaluation methods- From Association Mining to Correlation Analysis, Classification, Decision Tree Introduction, Bayesian Classification Methods, Rule Based Classification, Prediction: Linear Regression.

Module 3   CLUSTER ANALYSIS   *(09 Periods)*
Cluster Analysis: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods-k-Means and K-Medoids, Hierarchical methods-Agglomerative and divisive method, Density-Based Method-DBSCAN, Grid-Based Method-STING, Outlier Analysis.

Module 4   **DATA MINING TRENDS**   *(09 Periods)*

Mining Complex Data Types: Mining sequence data, Mining other kinds of data: Spatial, Text, Multimedia and Web data.

Data Mining Trends: Mining Complex Data Types, Methodologies of Data Mining, Data Mining Applications, Data Mining and Society, Data Mining Trends.

Module 5   **VISUALIZATION OF MULTI-DIMESIONAL DATA**   *(09 Periods)*

Introduction, Diagrams for Multidimensional visualization, Kiviat diagrams, 3D Scattergram, 3D Line Graph, Chernoff Faces, Volume Rendering, **Visual Data Mining** - Animation

Total Periods: 45

(It'sanindicativeone. TheCourseInstructormaychangetheactivities andthesame shall be reflected in Course Handout)

RESOURCES

TEXTBOOKS:
1. JiaweiHan, Micheline Kamber and JianPei, Data Mining: Concepts and Techniques, Elsevier, Third Edition, 2013.

REFERENCEBOOKS:
1. K.P.Soman, Shyam Diwakar andV.Ajay, Insight into Data mining Theory and Practice, Easter Economy Edition, Prentice Hall of India, 2006.
2. G.K.Gupta, Introduction to Data Mining with Case Studies, Easter Economy Edition, Prentice Hall of India, 2006.
3. TanP.N, Steinbach M. and Kumar V., Introduction to Data Mining, Addison-Wesley, 2006.

VIDEOLECTURES:
1. https://onlinecourses.nptel.ac.in/noc21_cs06/preview
2. https://www.coursera.org/specializations/data-mining-foundations-practice
3. Data Mining | Coursera

WEBRESOURCES:
1. Data Mining. Concepts and Techniques, 3rd Edition (The Morgan Kaufmann Seriesin Data Management Systems) (sabanciuniv.edu)

Course Code	Course Title	L	T	P	S	C
22CB101019	**MOBILE DATABASES**	3	-	-	-	3

Pre-Requisite   Computer Networks and Database Management Systems
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: Mobile Database, Wireless Network Communication, Location and Handoff Management, Fundamentals of Database Technology, Concurrency Control Mechanism Data Processing and Mobility, Transaction management in Mobile Database systems, Mobile database Recovery.

COURSE OUTCOMES: *After successful completion of this course, the students will be able to:*
CO1. Demonstrate knowledge on:
   • Mobile databases
   • Wireless Network communications
   • Location and Handoff management.
CO2. Analyze the conventional approaches of data processing and build a transaction model.
CO3. Identify the concurrency control schemes for mobile database systems.
CO4. Demonstrate knowledge on the transaction management in mobile database   systems.
CO5. Demonstrate knowledge on the various mobile database recovery schemes.

CO-PO-PSO MappingTable:

Course Outcomes	ProgramOutcomes												ProgramSpecific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	-	-	-
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	-	-	-
CO4	2	3	3	-	-	2	-	-	-	-	-	-	3	-	-	-
CO5	2	2	3	-	2	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	3	-	2	2	-	-	-	-	-	-	3	-	-	-

CorrelationLevels: 3:High;   2: Medium;   1:Low

COURSE CONTENT:

Module-1: INTRODUCTION   (10 periods)
Mobile Database: Introduction, Fully Connected Information Space, Types of Mobility.
Wireless Network Communication: Introduction, Continuous Connectivity.
Location and Handoff Management: Location Management, Handoff Management, Roaming.

Module-2: FUNDAMENTALS OF DATABASE TECHNOLOGY   (9 periods)
Conventional Database Architecture, Database Processing, Serialization of Transaction, Advanced Transaction Model

Module-3: CONCURRENCY CONTROL MECHANISM & DATA PROCESSING AND MOBILITY   (10 periods)
Concurrency Control Mechanism: Introduction, ways of locking data items. The Phantom Problem, Multi-granularity locking, Heuristics approach in locking scheme, Non-locking based schemes.

Data Processing and Mobility: Introduction, Effect of mobility on the management of data, Data Categorization, Location dependent data distribution.

Module-4: TRANSACTION MANAGEMENT IN MOBILE DATABASE SYSTEMS
(10 periods)

Mobile Database systems, Transaction execution in MDS, Mobile Transaction Model, Execution model on ACID transaction framework, pre-write transaction execution model, data consistency in intermittent connectivity.

Module-5: MOBILE DATABASE RECOVERY   (6 periods)
Introduction, Log Management in Mobile Database systems, Mobile database recovery scheme

Total Periods: 45

RESOURCES
TEXT BOOK:
1. Vijay Kumar, *Mobile Database Systems*, John Willy and Sons, 1stEdition, 2006.

REFERENCE BOOKS:
1. Elmasri, Navathe, *Fundamentals of Database Systems*, 3rdEdition, Pearson Education, 2000.
2. Henry F Korth, Abraham Silberschatz, S. Sudharshan, *Database System Concepts*, 5thEdition, McGraw Hill, 2006.
3. V. S. Subramanian, *Principles of Multimedia Database Systems*, Harcourt India Pvt Ltd., 2001.

VIDEO LECTURES:
*   *https://www.youtube.com/watch?v=KitL8hhA_BY*
*   *https://www.youtube.com/watch?v=lH9sYQqz-1U*

WEB RESOURCES:
*   *https://www.geeksforgeeks.org/mobile-database/*
*   *https://www.javatpoint.com/mobile-databases-in-dbms*

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22DS102002	**BIG DATA TECHNOLOGIES**	3	-	2	-	4

Pre-Requisite   Database Management Systems
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Hadoop Basics, Hadoop Distributed File system, MapReduce, Hive, Pig and HBase,Zookeeper, Sqoop and Big data Case Studies.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Demonstrate knowledge on Big Data characteristics, storage, processing, querying and reporting
CO2. Analyze large dataset issues and solve using data analytic techniques.
CO3. Design and Develop classification and clustering models for dataset analysis.
CO4. Solve large data analysis problems using Big data techniques.
CO5. Apply Big Data Tools: Sqoop, HBase, Hive, Pig,MapReduce and Zookeeper for large
CO6. Work independently and in teams to solve Big Data problems with effective communications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	0
CO2	2	2	3	-	-	1	-	-	-	-	-	-	3	-	-	2
CO3	2	2	2	3	-	-	2	-	-	-	-	-	3	-	-	2
CO4	2	3	-	-	2	-	-	-	-	-	-	-	3	-	-	2
CO5	-	-	-	-	-	-	-	2	3	-	-	-	3	-	-	0
CO6	-	-	-	-	-	-	-	-	-	3	-	2	3	-	-	0
Level of correlation of the course	3	3	3	3	2	1	2	2	3	3	-	2	3	-	-	2

Correlation Levels: 3: High   2: Medium   1: Low

COURSE CONTENT:

Module 1 - INTRODUCTION TO BIG DATA AND HADOOP   (9 periods)
Introduction to Big Data: Evolution and Definition of Big Data, Structure of Big Data, Characteristics, Advantages, Applications and Tools.
Hadoop: Data storage and analysis, Comparison with other systems, History of Hadoop, Apache Hadoop and the Hadoop Ecosystem, Hadoop Releases.

Module 2 – HADOOP DISTRIBUTED FILE SYSTEM AND HADOOP I/O (9 periods)
Hadoop Distributed File system: HDFS concepts, Command-Line Interface, Hadoop file systems, Java Interface, Data Flow, Hadoop Archives.
Hadoop I/O: Data Integrity, Compression, Serialization, File-Based Data Structures.

Module 3 – MAPREDUCE, TYPES& FORMATS AND FEATURES   (9 periods)
MapReduce: Analyzing the data with Hadoop, Scaling Out, Hadoop Streaming, Hadoop Pipes.
Types and Formats: MapReduce Types, Input Formats, Output Formats.
Features: Counters, Sorting, Joins, Side Data Distribution and MapReduce Library Classes.

Module 4– HIVE, PIG AND HBASE   (9 periods)
Hive: Comparison with Traditional Databases, HiveQL, Tables, Querying Data, and User-Defined Functions.
Pig: Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators.
HBase: Basics, Concepts, Clients, HBase vs. RDBMS, Praxis.

Module 5– ZOOKEEPER, SQOOP AND CASE STUDIES   (9 periods)
Zookeeper: Zookeeper Service, Building applications with Zookeeper, Zookeeper in production.
Sqoop: Database Imports, working with Imported Data, Importing Large Objects, Performing an Export.
Case Studies: WhatsApp, Facebook and Twitter.

                                                                          Total periods: 45

EXPERIENTIAL LEARNING:
1. Practice on Hadoop:
i. Hadoop installation and Cluster Configuration.
       ii. Create Name node, Secondary Name node in Safe mode.
       iii. Create Hadoop File system Shell and Read and write Data.
2. **Practice on MapReduce:**
i. Create file to count the number of words and display the same.
       ii. Create zip file of weather report and fetch the max temperature value from the
           report
3. Install and Run Hive and Hbase, then use Hive to create, alter, and drop databases,
   tables, and perform views, functions, indexes and Joins.
4. Perform Data Processing Operators using **Pig.**
5. **Import and Export data from RDBMS database using Sqoop tool**.
6. **Perform data storage and management using Zookeeper tool.**
7. **Install Spark and Pyspark in Windows and Ubuntu.**
8. Practice on Spark
i) Spark Transformations i.e. map(), filter(), flatmap(), groupBy(),   groupByKey(),
sample(), union (), join(), distinct(), keyBy(), partitionBy   and zip().
ii) Spark Actions i.e. getNumPartitions(), collect(), reduce(), aggregate (),   max(), sum(),
mean(), stdev(), countByKey().
9. Writea Scala program for Linear Search,BinarySearch,Bubble Sort ,Quick Sort, and
     Stack operations.
10. Practice on PySpark
      i) Actions and Transformation commands.
      ii) Program for implementation of bubble sort and Selection Sort
     iii) Program for implementation of stack and Queue
11. Case study 1: Insurance Domain
       i) Perform Hive operations on Insurance Dataset
       ii) Perform Pig Data Processing Operators on Insurance Dataset
12. Case study 2: Healthcare Domain
       i) Perform Hive operations on Insurance Dataset
       ii)Perform Pig Data Processing Operators on Insurance Dataset

RESOURCES

TEXT BOOKS:
1. Tom White, *Hadoop: The Definitive Guide***,**O'REILLY Publications, Third Edition, 2012.
2. Anil Maheswari, *Big Data***,**Tata McGraw Hill,First Edition, 2017.

REFERENCE BOOKS:

1. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications," Wiley Publications, 2014.
2. Paul Zikopoulos, IBM, Chris Eaton and Paul Zikopoulos "Understanding Big Data: Analytics for Enterprise Class Hadoop and streaming Data," The McGraw-Hill Companies, 2012.
3. Chuck Lam "Hadoop in action," Manning Publications, 2011.

SOFTWARE/Tools Used:
1. An Intel-compatible platform running Windows 10 /8.1/8 /7 /Vista /XP /2000 Windows server 2019 /2016 /2012 /2008 /2003
2. At least 256 MB of RAM, a mouse, and enough disk space for recovered files, image files, etc.
3. The administrative privileges are required to install and run Big Data utilities.
4. A network connection for data recovering over network.

VIDEO LECTURES:
1. https://www.youtube.com/live/KCEPoPJ8sWw?feature=share
2. https://youtu.be/bAyrObl7TYE

WEBRESOURCES:
1. https://www.simplilearn.com/introduction-to-big-data-and-hadoop-tutorial
2. https://hadoop.apache.org/docs/r1.2.1/hdfs_design.html
3. https://www.developer.com/java/understanding-mapreduce-types-and-formats.html
4. https://prismoskills.appspot.com/lessons/System_Design_and_Big_Data/Chapter_01_-_Hadoop.jsp
5. https://www.simplilearn.com/introduction-to-zookeeper-tutorial
6. https://data-flair.training/blogs/top-hadoop-hdfs-commands-tutorial/
7. https://www.edureka.co/blog/hive-commands-with-examples
8. https://www.tutorialspoint.com/apache_pig/apache_pig_grunt_shell.htm
9. Transformations and Actions (databricks.com)

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101020	**DIGITAL AND SOCIAL MEDIA MARKETING**	3	-	-	-	3

Pre-Requisite: Computer Networks
Anti-Requisite:-
Co-Requisite:-

COURSE DESCRIPTION: This course shall explain about Digital marketing strategies,different types of social media marketing tools,understanding customer journeys,usiness Model for e-commerce,structure a digital marketing strategy,Setting SMART objectives,The Operations and Marketing Connection,Social CRM and Blogger Outreach, Engagement as a Business Activity.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1 Demonstrate knowledge on digital Marketing Strategies.
CO2 Analyze the marketing potential of digital technologies and social media platforms for a particular real-life marketing challenge.
CO3 Analyze digital marketing strategies for improving digital marketing
CO4 Identify the Scope of Social Interaction,Customer Relationships.
CO5 Design social business Techniques for business analysis

CO-PO-PSOMappingTable:

Course Outcomes	ProgramOutcomes												ProgramSpecific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	-	-	-
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	-	-	-
CO4	2	3	3	-	-	2	-	-	-	-	-	-	3	-	-	-
CO5	2	2	3	-	2	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	3	-	2	2	-	-	-	-	-	-	3	-	-	-

CorrelationLevels: 3:High;   2: Medium;   1:Low

COURSE CONTENT:

Module-1: INTRODUCTION TO DIGITAL MARKETING   (9 Periods)

Digital Marketing Fundamentals, Key features of digital marketing strategies, Applications of Digital Marketing, Benefits of Digital marketing, Alternative digital business models, The relationship between digital and traditional communications, different types of social media marketing tools, Key communications concepts for digital marketing.

Module-2: ONLINE MARKETPLACE ANALYSIS   (9 Periods)

Situation analysis for digital marketing, Digital marketing environment, Understanding customer journeys, Consumer behavior and implications for Marketing, Competitors, Suppliers, Business Model for e-commerce.

Module-3: DIGITAL MARKETING STRATEGY **(9 Periods)**

The need for an integrated digital marketing strategy, How to structure a digital marketing strategy,Situation analysis,Setting goals and objectives for digital marketing, Strategy formulation for digital marketing,The need for integrated digital marketing , strategy implementation. Setting SMART objectives.

Module-4: SOCIAL MEDIA AND CUSTOMER ENGAGEMENT **(9 Periods)**

The Social Feedback Cycle,The Social Web and Engagement,The Operations and Marketing Connection,The New Role: Social Interaction,Customer Relationships: CRM Gets Social,Outreach and Influencer Relations, Social CRM and Blogger Outreach,Build a Social Business.The Social Business Ecosystem.

Module-5: SOCIAL TECHNOLOGY AND BUSINESS DECISIONS **(9 Periods)**

Create a Social Business,Understand the Conversations That Matter,Social CRM and Decision Support,Social Analytics,Know Your Influencers,Engagement on the Social Web,Engagement as a Customer Activity,Engagement as a Business Activity,Social CRM and Business Design.

Total Periods: 45

RESOURCES

TEXT BOOKS:

1. Dave chaffey and Fiona ellis-chadwick,Digital Marketing strategy, implementation and, 6thEdition, 2016.

2. Dave Evans ,Social Media Marketing: The Next Generation of Business Engagement,Wiley Piblishing.Inc,2010

REFERENCE BOOKS:

1. Ryan, Damian; Understanding Digital Marketing: marketing strategies for engaging the digital generation; Kogan Page,3rdEdition, 2014.

2. MoutsyMaiti: Internet Mareting, Oxford University Press India

3. Eric Greenberg, and Kates, Alexander; Strategic Digital Marketing: Top Digital Experts Share the Formula for Tangible Returns on Your Marketing Investment; McGraw-Hill Professional, 2013.

VIDEO LECTURES:

- https://www.youtube.com/watch?v=QQCWHgclGB8

- https://www.youtube.com/watch?v=InL9bo-vKXs

WEB RESOURCES:

- https://www.emerald.com/insight/content/doi/10.1108/09696470510611384/full/html?skipTracking=true

- https://link.springer.com/book/10.1007/978-0-387-71001-3

Course Code	Course Title	L	T	P	S	C
22CS102010	**ADVANCED JAVA PROGRAMMING**	3	-	2	-	4

Pre-Requisite   Object Oriented programming through Java
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course shall explain methods to develop, compile, debug, and run advanced Java programs. It covers the advanced Java language, including its on key portions of the Java API library, such as the Collections Framework, the stream library, and the concurrency utilities.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Concept of Lambda expressions using variable capture, Generic and method references
CO2. Design and Analysis the Database connection using jdbc programs
CO3. Implement Servlets and cookies concepts using server
CO4. Using Regular Expressions, networking And client server using RMI
CO5. Use Synchronizers effectively for the interaction between multiple threads

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3	-
CO2	3	3	-	-	-	-	2	-	-	-	-	-	3	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	2	-	3	-	3	-
CO4	2	3	3	-	-	-	-	2	-	-	-	-	3	-	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-	3
Course Correlation Mapping	3	3	3	-	-	-	2	2	-	-	2	-	3	-	3	3

Correlation Levels: 　　3: High; 　　2: Medium; 1: Low

COURSE CONTENT

Module 1 LAMBDA EXPRESSIONS   **(09 periods)**
Introduction-functional interfaces-block lambda expressions-generic functional interfaces-passing lambda expressions as arguments-exceptions-variable capture-method references to static methods-method references to instance methods-method references with generics

Module 2 JDBC   **(09 Periods)**
Introduction-JDBC drivers-JDBC architecture-JDBC classes and interfaces-loading drivers-making a connection-execute SQL statement-SQL statements-retrieving result-scrollable and updatable resultset.

Module 3 SERVLETS   **(09 Periods)**

Server-side Java-Advantages over applets-servlet architecture-life cycle- generic servlet-HTTP Servlet-passing parameters to servlets-retrieving parameters-Cookies-problem with servlet.

Module 4 REGULAR EXPRESSION   (09 Periods)
Processing Regular Expression - Pattern - Matcher - Syntax -Two pattern matching option.
Remote Method Invocation: A Simple Client/Server Application Using RMI.
Networking:Basics - java.net - InetAddress - TCP/IP client sockets - TCP/IP server sockets - Datagrams.

Module 5 CONCURRENCY UTILITIES   (09 Periods)
Concurrent API packages - Synchronization objects - Executor - Concurrent collections - Locks - Atomic operations - Parallel Programming.

Total : 45 hours

EXPERIENTIAL LEARNING
1) Write a java program to find the factorial using Generic functional interface in lambda expressions?
2) Write a Java program to implement a lambda expression to find the second largest and smallest element in an array.
3) Write a java program that connects to a database using JDBC and does add, delete, modify and retrieve operations.
4) Write a java program for callable statement statement to execute stored procedure in jdbc?
5) Write a servlet program which retrieves the data from database
6) Write a java program to demonstrate a Http servlet?
7) Write a Java program that implements a simple client/server application. The client sends data to a server. The server receives the data, uses it to produce a result, and then sends the result back to the client. The client displays the result on the console. For ex: The data sent from the client is the radius of a circle, and the result produced by the server is the area of the circle. (Use java.net)
8) Write a Java program to retrieve the information from the given URL? (Note: Read the URL from Command Line Arguments).
9) Demonstrate multi-threading with concurrency control implementation.
10) Perform string (Email and password) validation using regular expression.

RESOURCES

TEXT BOOK:
1. Herbert Schildt, Java Complete Reference 11th Edition, Oracle Press, 2019
   Reference Books
2. Kathy Sierra, Bert Bates, Head First java, O'REILLY, 2019.

SOFTWARE/TOOLS:
1. Software: Eclipse / Net beans / JDK 1.7
2. Java compatible web browser

VIDEO LECTURES:
1. https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2. https://www.udemy.com/course/advanced-java-programming/

WEB RESOURCES:
1. https://www.tutorialspoint.com/java/java_tutorial.pdf
2. https://www.guru99.com/java-tutorial.html

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CS105001	**R PROGRAMMING**	-	1	2	-	2

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Introduction to R, R Programming Structures, Doing Math and Simulation in R, Creating Graphs, Probability Distributions, correlation andRegression and Random Forests.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:
CO1. Apply R programming constructs to store and manipulate datasets.
CO2. Develop modules using R programming constructs to solve statistical problems.
CO3. Perceive data models to perform descriptive and inferential statistical analysis to identify trends, patterns in data.
CO4. Create effective visualization using Histograms, Bar plots, Box plots, Scatter plots for exploratory data analysis.
CO5. Work independently to solve problems with effective communication.

CO-PO-PSO Mapping Table

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	-	-	2	3	-	-	-	-	-	-	-	3	-	-	
CO2	3	1	1	1	3	-	-	-	-	-	-	-	3	-	-	
CO3	3	3	2	3	3	-	-	-	-	-	-	-	3	-	-	
CO4	3	3	2	3	3	-	-	-	-	-	-	-	3	-	-	
CO5	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	
Course Correlation Mapping	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**-**	**-**	

Correlation Level: 3- High 2-Medium 1- Low

COURSE CONTENT

Module1:   INTRODUCTION TO R   (08 Periods)
Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

Module2:   R PROGRAMMING STRUCTURES   (10 Periods)

R Programming Structures, Control Statements, Loops, -Looping Over Nonvector Sets,-If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return-Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree.

Module3   DOING MATH AND SIMULATION IN R   (10 Periods)

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability-Cumulative Sums and Products-Minima and Maxima-Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product-Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /out put, Accessing the Keyboard and Monitor, Reading and writer Files.

Module4   **GRAPHICS**   **(8 Periods)**

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.

Module5   **PROBABILITY DISTRIBUTIONS AND**   **(9 Periods)**
                       REGRESSION MODELS
Probability Distributions, Normal Distribution-Binomial Distribution-Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA. Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, -Poisson Regression-other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines-Decision-Random Forests.

                                              TotalPeriods:45

EXPERIENTIAL LEARNING:

Datatypes, Variables, Operators, Data structures – Vectors, Arrays, Matrices, Lists, Data frames; Object oriented programming – S3, S4 classes; Selection statements – if statement, if else statement, switch statement; Iterative statements – For loop, While loop, Repeat loop, Nested loops; Functions – Creating functions, Default values for arguments, Return values, Environment and scope issues, Recursion.

1. Create the vectors:
   a)   (1, 2, 3, . . . , 19, 20)
   b)   (20, 19, . . . , 2, 1)
   c)   (1, 2, 3, . . . , 19, 20, 19, 18, . . . , 2, 1)
   d)   (4, 6, 3) and assign it to the name tmp.
     For parts (e), (f) and (g) look at the help for the function rep.
   e)   (4, 6, 3, 4, 6, 3, . . . , 4, 6, 3) where there are 10 occurrences of 4.
   f)   (4, 6, 3, 4, 6, 3, . . . , 4, 6, 3, 4) where there are 11 occurrences of 4, 10 occurrences of 6 and 10 occurrences of 3.
   g)   (4, 4, . . . , 4, 6, 6, . . . , 6, 3, 3, . . . , 3) where there are 10 occurrences of 4, 20 occurrences of 6 and 30 occurrences of 3.

2. a)   Write R code that will generate a vector with the following elements. "aa" "ba" "ca" "da" "ea" "ab" "bb" "cb" "db" "eb" "ac" "bc" "cc" "dc" "ec" "ad" "bd" "cd" "dd" "ed" "ae" "be" "ce" "de" "ee"

   b)   Write a R program to create a Dataframes which contain details of 5 employees and display summary of the data.

3. a)   Create a vector of a data set and treat it as an object. Using the vector and object perform (.) dot product and (x) cross product. Take your own data.

   b)   "Fizzbuzz" is a simple programming challenge often used at interviews to test very basic programming skill. Your goal is the following: for the numbers 1 to 100, print "fizz" if the number is a multiple of 3, "buzz" if the number is a multiple of 5, "fizzbuzz" if the number is a multiple of both 3 and 5, and simply print the number otherwise.

4. a)   Imagine a high school with 1000 lockers all in a row, numbered 1 to 1000 in order. At the start, all of them are closed. 1000 students are sent, one after the other, to change the state of a set of lockers (from open to closed or closed to open). The first student changes the state of all lockers. The second changes the state of every other one (2, 4, 6, 8, . . .). The third changes the state of every third one (3, 6, 9, 12, . . .). This process continues until all 1000 students have gone.

Write a R program to determine which lockers are open at the end of this process?

b)   Write a function chomp() that, given a string, removes from the string any occurrence of the character &, as well as the character to the left of each & character. So, for example, your function should return:
> chomp (" a&c ")
" c "
> chomp (" a&")
 " "
> chomp (" abc ")
" abc "

5.   a)   Write a function which takes a single argument which is a matrix. The function should return a matrix which is the same as the function argument but every odd number is doubled.

b)   Write a function that takes an array of numbers x and returns the smallest number in the array.

Importance and applications of statistical learning, Types of data, Types of variables, Frequency distributions, Measures of center – Mean, Median, Mode; Measures of spread – Range, Percentile, Quartiles & Interquartile range, Standard deviation, Variance; Correlation and Covariance.

6.   a)   Compute descriptive statistics for the data given below.
X: 14, 20, 22, 19, 15, 18, 30, 27
Y: 16, 25, 27, 20, 16, 18, 27, 23

b)   Write a R script which will compute the mean and variance of the vector x <- 1:100. Compare with R's internal mean() and var() functions.

7.   Write a function to compute running medians. Running medians are a simple smoothing method usually applied to time-series. For example, for the numbers 7,5, 2, 8, 5, 5, 9, 4, 7, 8, the running medians of length 3 are 5, 5, 5, 5, 5, 5, 7, 7. The first running median is the median of the three numbers 7, 5, and 2; the second running median is the median of 5, 2, and 8; and so on. Your function should take two arguments: the data (say, x), and the number of observations for each median (say, length).

8.   Write a R program to perform data import/export (.csv, .xlxs) operations using data frames in R.

9.   Write a R program to create bell curve of a random normal distribution.

10. Write a R program to design correlation matrix by choosing appropriate dataset.

RESOURCES

TEXTBOOKS:
1. The Art of R Programming, Norman Matloff, Cengage Learning
2. R for Everyone, Lander, Pearson

REFERENCEBOOKS:
1. SandipRakshit, R for Beginners, McGraw Hill, 2017.
2. SeemaAcharya, Data analytics using R, McGraw Hill, 2018.

VIDEO LECTURES:
1. https://www.classcentral.com/course/rprog-1713
2. https://www.youtube.com/playlist?list=PLVext98k2evi8mDNRo4MwIgVgSmwM3cS8
3. https://www.udemy.com/topic/r-programming-language/

WEB RESOURCES:
1. https://www.stats.ox.ac.uk/~evans/Rprog/LectureNotes.pdf
2. https://www.tutorialspoint.com/r/r_tutorial.pdf
   https://www.tutorialsduniya.com/notes/r-programming-notes/

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB102007	**NETWORK PROGRAMMING**	3	-	2	-	4

Pre-Requisite   - Computer Networks
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion on Introduction to Network Programming; Sockets;TCP Client Server; I/O multiplexing and Socket Option; Elementary UDP Sockets; DNS; IPC; Remote Login.

COURSE OBJECTIVES:
CEO1: To impart basic and advanced knowledge in network programming.
CEO2: To develop programming skills in computer networking.
CEO3: To apply the programming knowledge skills to design and develop real time networks.

COURSE OUTCOMES: *After successful completion of the course, students will be able to*:
CO1. Demonstrate the knowledge in concepts of network programming and sockets.
CO2. Perform Client-Server communication using TCP and Socket Options.
CO3. Apply elementary UDP Sockets and Domain Name Serversfor Inter Process Communication.
CO4: Apply Pipes, FIFO's, streams and messages to establish IPC.
CO5: Apply remote login methods for accessing network assets remotely.
CO6: Work independently and in teams to solve network problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	3	3	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3	-
CO4	3	2	2	2	2	-	-	-	-	-	-	-	3	3	3	-
CO5	3	2	2	2	2	-	-	-	-	-	-	-	3	3	3	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
Course Correlation Mapping	3	2	2	2	2	**-**	**-**	**-**	**3**	**3**	**-**	**-**	3	3	3	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT:
Module-1: INTRODUCTION TO NETWORK PROGRAMMING AND SOCKETS
(09 Periods)

OSI model, Unix standards, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application.

Address structures, value result arguments, Byte ordering and manipulation function and related functions Elementary TCP sockets -Socket, connect, bind, listen, accept, fork and exec function, concurrent servers. Close function and related function.

Module-2: TCP CLIENT SERVER AND SOCKET OPTIONS   (09 Periods)
TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host. I/O Models, select function, Batch input, shutdown function, poll function, getsockopt and setsockopt functions. Socket states, Generic socket option IPV6 socket options.

Module-3: ELEMENTARY UDP SOCKETS AND DOMAIN NAME SERVERS(09 Periods)
Introduction UDP Echo server function, lost datagram, summary of UDP example, Lack of flow control with UDP, determining outgoing interface with UDP.

DNS, gethost by Name function, Resolver option, Function and IPV6 support, uname function, other networking information.

Module-4: INTERPROCESS COMMUNICATION   (09 Periods)
Introduction, Pipes, popen and pclose functions, FIFO's, streams and messages, System V IPC: IPC_Perm Structure, IPC Permissions, Creating and Opening IPC Channels, Message queues (msgget, msgsnd, msgrcv, msgctl Functions), Shared Memory (shmget, shmat, shmdt, shmctl Functions).

Module-5: **REMOTE LOGIN**   **(09 Periods)**
Terminal line disciplines, Pseudo-Terminals, Terminal modes, Control Terminals, rlogin Overview, RPC, Transparency Issues.

                                                       Total Periods: 45
EXPERIENTIAL LEARNING:
1. Write a Program to manipulate the IP address of a system.
2. Write a Program to obtain the information about the (a)Host (b)Port.
3. Write a Program to access daytime service from server using socket.
4. Write a Program to get remote and local socket address.
5. Write a Program to find port number running on server.
6. Write a Program to read the source code of the web page.
7. Write a Program to create socket for sending and receiving data.
8. Implement a simple TCP client-server where in a server acts as a time and date server.
9. Print a client address at server end.
10. Program an echo UDP Server.
11. Create a simple Chat Program.
12. Create a simple out of band Sending and Receiving program.

TEXT BOOKS:
1. W.Richard Stevens, "UNIX Network Programming," Vol. I, Sockets API, 3rd Edition, PHI, 2010
2. W.Richard Stevens, "UNIX Network Programming IPC," Vol. II, 2nd Edition, PHI,2009

REFERNCE BOOKS:
1. T Chan, "Unix Systems Programming Using C++," 3rd Edition, PHI.
2. Graham Glass, King Ables, "UNIX for programmers and Users," 3rd Edition, Pearson Education.
SOFTWARE/TOOLS:

- C/Java

VIDEO LECTURES:

1. https://www.udemy.com/topic/network-programming
2. https://www.youtube.com/watch?v=CLB1oBEROlg
WEB RESOURCES:

1. https://internalpointers.com/post/network-programming-beginners-overview
2. https://github.com/codeplea/Hands-On-Network-Programming-with-C

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CS102007	**LINUX PROGRAMMING**	3	-	2	-	4

Pre-Requisite Programming for Problem Solving

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Concepts on Linux Programming; Shell Programming; Process, Signals and File System Structure; Inter process Communications and Socket Programming for Client-Server Interaction.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on

- Shell programming

- File Structure and System Calls

- Processes management and handling signals,

- ☐ IPC and Sockets

CO2. Analyze shell scripts and system calls related to Linux Environment.

CO3. Design shell scripts and system calls for specified computational problems

CO4. Use appropriate shell scripts and system calls for solving complex problems.

CO5. Provide appropriate Linux solutions for real time applications

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3	-
CO2	3	3	-	-	-	-	2	-	-	-	-	-	3	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	2	-	3	-	3	-
CO4	2	3	3	-	-	-	-	2	-	-	-	-	3	-	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
Course Correlation Mapping	3	3	3	-	-	-	2	2	-	-	2	-	3	-	3	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

MODULE-1: INTRODUCTION TO LINUX AND LINUX ENVIRONMENT   (9 Periods)

The GNU project and the Free Software Foundation, Linuxdistributions, Programming Linux - Linux programs, Text editors,The C Compiler; Program arguments - getopt, getopt_long.Environment variables - Use of environment variables, Theenviron variable, Time and Date, User information, Hostinformation.

MODULE-2: SHELL PROGRAMMING   (9 Periods)

Necessity of shell programming, Pipes and redirection -Redirecting output, Redirecting input, Pipes, The Shell as aprogramming language - Interactive programs, Creating a script,Making a script executable, Shell syntax – Variables, Conditions,Control structures, Functions, Commands, Command execution.

MODULE-3: FILE SYSTEM STRUCTURE AND SYSTEM CALLS   (9 Periods)

Linux File Structure and Commands: File structure -Directories, Files and devices, System calls and Device drivers;Library functions - Low-level file access, write, read and opencommands, Initial permissions, Other system calls for managingfiles; File and directory maintenance commands - chmod, chown,unlink, link, symlink, mkdir, rmdir, chdir, getcwd.

Input-Output Commands: The standard I/O library commands- fopen, fread, fwrite, fclose, fflush, fseek, fgetc, getc, andgetchar, fputc, putc and putchar, fgets and gets; Formattedinput and output commands - printf, fprintf, sprintf, scanf,fscanf, sscanf.

MODULE-4: PROCESS AND SIGNALS   (8 Periods)

Process structure - Process table, Viewing processes, Systemprocesses, Process scheduling; Starting new processes – Waitingfor a process, Zombie processes, Input and output redirection,Threads; Signals - Sending signals, Signal sets.

MODULE-5: INTER-PROCESS COMMUNICATION AND SOCKETS   (10 Periods)

Inter-Process Communication: Pipe definition, Process pipes,Sending output to popen - Passing more data, popen,implementation, The pipe call; Parent and child processes -Reading closed pipes, pipes used as standard input and output;Named pipes – FIFOs, Accessing a FIFO, Client/Server usingFIFOs.

Socket Connections: Socket attributes, Creating a socket,Socket addresses, Naming a socket, Creating a socket queue,Accepting connections, Requesting connections, Closing asocket, Socket communications, Host and network byteOrdering.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Write a shell script to find the sum, the average and the product of the four integers entered

2. Write a shell program to exchange the values of two variables

3. Find the lines containing a number in a file

Echo "Enter filename"

Read filename

Grep [0-9] $filename

4. Write a shell script to display the digits which are in odd position in a given 5 digit number

5. Write a shell program to reverse the digits of five digit integer.

6. Write a shell program to convert all the contents into the uppercase in a particular file.

7. Find occurrence of particular digit in inputted number.

8. Write a shell program to find the position of substring in given string.

9. Write shell script to print alternate digits when a 7 digit number is passed as input

10. Write shell script to generate fibonacci series

RESOURCES:

TEXT BOOK:

1. Neil Matthew and Richard Stones, Beginning LinuxProgramming, Wiley Dreamtech, Fourth Edition, 2008.

REFERENCE BOOKS:

1. Richard Petersen, Linux: The Complete Reference, TataMcGraw-Hill, Sixth edition, 2007.

2. Sumitabha Das, Your UNIX: The Ultimate Guide, TataMcGraw-Hill, 2007.

SOFTWARE/TOOLS:

1.   https://learn.microsoft.com/en-us/windows/wsl/install

2.   https://www.geeksforgeeks.org/essential-linuxunix-commands/

VIDEO LECTURES:

1.   https://www.youtube.com/watch?v=k4Ww6gFeF0M

2.   https://www.youtube.com/watch?v=vLPdBp9vv9Y

3.   https://www.youtube.com/watch?v=lqYSCSgFefM&list=PL6UwySlcwEYIZGsbXnUxsoj D0yeUA67lb

WEB RESOURCES:

1.   https://www.udemy.com/course/bash-shell-scripting-crash-course-for-beginners

2.   https://www.geeksforgeeks.org/essential-linuxunix-commands

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CS104001	**MERN STACK DEVELOPMENT**	3	-	2	4	5

Pre-Requisite   Web Technologies

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course is a practical introduction to React Native, the JavaScript framework for writing and deploying fully featured mobile apps that look and feel native. The students will learn how to build applications that target iOS, Android, and other mobile platforms instead of browsers.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the lifecycle of the components in React and build a basic native mobile application

CO2. Realize the difference between HTML elements and Native components including platform specific components.

CO3. Detect the platform in which app is running and implement platform-specific code.

CO4. Debug the JavaScript code in applications using debugging tools.

CO5. Configure, test, and deploy the applications with respect to the platform.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3	
CO2	3	3	-	-	-	-	2	-	-	-	-	-	3	-	3	
CO3	3	3	3	-	-	-	-	-	-	-	2	-	3	-	3	
CO4	2	3	3	-	-	-	-	2	-	-	-	-	3	-	-	
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-	
Course Correlation Mapping	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**2**	**–**	**-**	**2**	**-**	**3**	**-**	**3**	

Correlation Levels: **3: High;**   **2: Medium; 1: Low**

COURSE CONTENT:

Module- 1: INTRODUCTION **(09 periods)**

React Native – Advantages – Drawbacks - Rendering Lifecycle - Creating Components in React Native - Host Platform APIs - Building a Weather App

Module -2: COMPONENT FOR MOBILE **(09 periods)**

Analogies Between HTML Elements and Native Components - Touch and Gestures - Organizational Components - Platform-Specific Components - Declaring and Manipulating Styles

Module 3: PLATFORM APIS **(09 periods)**

Using Geolocation - Accessing the User's Images and Camera - Storing Persistent Data with AsyncStore - The SmarterWeather Application

Module 4 DEBUGGING AND DEVELOPER TOOLS **(09 PERIODS)**

JavaScript Debugging Practices, Translated - React Native Debugging Tools – Debugging Beyond JavaScript – Type-Checking with flow - Modeling and Storing Data

Module 5 DEPLOYMENT IN IOS **(09 PERIODS)**

Preparing Xcode Project - Uploading Application - Creating an Archive - Creating an App in iTunes Connect - Beta Testing with TestFlight

Deploying Android Applications - Building the APK for Release - Distributing via Email or Other Links - Submitting Your Application to the Play Store.

EXPERIENTIAL LEARNING

1. Develop an application that uses GUI components, Font and Colors
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi-threading
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.

RESOURCES

Text Book

1. Bonnie Eisenman Learning React Native, O'Reilly 2020.

Reference Books(s)

1. Dan Ward, React Native Cookbook Second Edition, Packt, 2020.
2. Emilio Rodriguez Martinez, React : Cross platform application development with React Native, 2020.

SOFTWARE/TOOLS:

1. Software: Node.js, MongoDB and Visual Studio Code; Express and React modules.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=E-GA9GKJWuE
2. https://www.youtube.com/watch?v=Oe421EPjeBE
3. https://www.youtube.com/watch?v=KNZZZ3pbqco
4. https://www.youtube.com/watch?v=bbkBuqC1rU4

WEB RESOURCES:

1. Node.js Tutorial - https://www.w3schools.com/nodejs/
2. Express.js Tutorial - https://www.javatpoint.com/expressjs-tutorial
3. MongoDB Tutorial - https://www.tutorialspoint.com/mongodb/index.htm
4. Learn ReactJS Tutorial - https://www.javatpoint.com/reactjs-tutorial
5. Redux Tutorial - https://www.tutorialspoint.com/redux/index.htm

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PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CS104002	**MOBILE APPLICATION DEVELOPMENT**	3	-	2	4	5

Pre-Requisite   Object Oriented Programming through Java
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: Mobile platforms; Mobile User Interface and tools; Introduction to Android; Activities; Views; Menus; Database Storage; SMS; e-mail; Displaying Maps; Building a Location Tracker Web Services Using HTTP; Sockets Programming; Communication between a Service and an Activity; Introduction to iOS.

COURSE OUTCOMES: *After successful completion of this course, the students will be able to:*
CO1. Demonstrate knowledge on mobile platforms, mobile user interface and user interface design requirements.
CO2. Design user interfaces by analyzing user requirements.
CO3. Develop mobile applications for Messaging, Location-Based Services, And Networking.
CO4. Develop mobile applications and publish in different mobile platforms.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	1	2	3	2	-	-	-	-	-	-	-	-	3	-	-	-
CO3	1	2	2	2	3	2	2	1	-	-	-	-	3	-	-	2
CO4	1	2	3	2	3	2	2	1	-	-	-	-	3	-	-	-
Course Correlation Mapping	2	2	3	2	3	2	2	1	-	-	-	-	3	-	-	2

Correlation Level: 3-High; 2-Medium; 1-Low

COURSE CONTENT:

Module - I: INTRODUCTION AND MOBILE USER INTERFACE DESIGN   **(8 periods)**
Mobile web presence, Mobile applications, Marketing, App as a mobile web app; User interface design - Effective use of screen real estate, Mobile application users, Mobile information design, Mobile platforms, Tools of mobile interface design.
Android versions, Features and architecture, Required tools, Android application launching.

Module - II: ACTIVITIES, INTENTS AND ANDROID USER INTERFACE   **(9 periods)**
Activities, Linking activities using intents, Calling Built – In Applications Using Intents, Displaying notifications, Components of a screen, Adapting to display orientation, Managing changes to screen orientation, Utilizing the action bar, Listening for UI notifications.

Module-III: ADVANCED USER INTERFACE AND DATA PERSISTENCE   **(10 periods)**
Basic views, Picker views, List view, Image view, Menus with views, Web view, Saving and loading user preferences, Persisting data to files, Creating and using databases.

Module IV: MESSAGING, LOCATION-BASED SERVICES, AND NETWORKING (9 Periods)

SMS messaging, Sending e-mail, Displaying maps, Getting location data, Monitoring a location, Consuming web services using HTTP.

Module- V: ANDROID SERVICES, PUBLISHING ANDROID APPLICATIONS AND IOS
(9 Periods)

Services, Communication between a service and an activity, Binding activities to services, Threading, Preparing for publishing, Deploying APK files.
iOS tools, iOS project, Debugging iOS apps, Objective-C basics, Hello world app, Building the derby app in iOS.

Total Periods: 45

EXPERIENTIAL LEARNING
1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager.
6. Implement an application that uses Multi-threading.
7. Develop a native application that uses GPS location information
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message
10. Write a mobile application that makes use of RSS feed

MINI-PROJECT
11. Develop a mobile application to send an email.
12. Develop a Mobile application for simple needs

TEXT BOOKS:
1. J. F. DiMarzio, "Beginning Android Programming with Android Studio," Wiley India, Fourth Edition, 2017.
2. Wei – Meng Lee, "Beginning Android 4 Application Development", Wrox, 2017.
3. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development," Wiley India, First   Edition, 2012.

REFERENCE BOOKS:
1. Neils Smyth "Android Stduio Development Essentials," Creative Space Independent publishing platform, Seventh edition 2016.
2. Paul Deital and Harvey Deital, "Android How to Program," Detial associates publishers, First Edition, 2013.

SOFTWARE/TOOLS:
1.   Software: Eclipse / Net beans / JDK 1.7
2.   Java compatible web browser

VIDEO LECTURES::
1. https://www.youtube.com/playlist?list=PLknSwrodgQ72X4sKpzf5vT8kY80HKcUSe
2. https://www.udemy.com/topic/android-development/free/
3. https://www.udemy.com/course/mobile-application-development-using-android/

WEB RESOURCES:
1. https://developer.android.com/
2. https://egyankosh.ac.in/handle/123456789/70868
3. https://www.tru.ca/distance/courses/comp2161.html

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101003	**SECURE SOFTWARE ENGINEERING**	3	-	-	-	3

Pre-Requisite   Software Engineering and Computer Networks
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion on Concepts of Software Security Engineering provides tools, techniques and methods to support the development and maintenance of systems that can resist malicious attacks that are intended to damage a computer-based system or its data. This course includes importance of security in software, requirements engineering, security principles in SDLC, security & complexity and governance & managing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Understand the importance of security in software and specify security properties.
CO2. Applying methods to detect software security defects, SQUARE process model for requirement gathering and coding practices.
CO3. Analyze complex software projects to describe security risks and mitigation techniques and security testing for identifying security failures.
CO4. Analyze research issues in code analysis techniques to improve software security.
CO5. Apply Governance and Managing for more secure software.
CO6. Interpret ethical principles in security and privacy in the areas of secure software and follow in professional practice

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	2	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	3	2	2	-
CO4	3	2	3	2	3	-	-	-	-	-	-	-	3	2	2	3
CO5	3	2	2	3	-	-	-	-	-	-	-	-	3	2	2	3
Course Correlation Mapping	**3**	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**2**	**3**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   IMPORTANCE OF SECURITY IN SOFTWARE   *(11 Periods)*
Security a Software Issue: Introduction, The problem, Software Assurance and Software Security, Threats to software security, Sources of software insecurity, Benefits of detecting software security defects early, managing secure software development.
Secure Software: Introduction, Properties of Secure Software, Influencing the security properties of software, Asserting and specifying the desired security properties.

Module 2:   REQUIREMENTS ENGINEERING   *(10 Periods)*
Requirements Engineering for Secure Software: Introduction, Misuse and abuse cases, the SQUARE process Model, SQUARE sample outputs, Requirements elicitation, Requirements prioritization.

Module 3   SECURITY PRINCIPLES IN SDLC   *(11 Periods)*
***Secure Software Architecture and Design*:** Introduction, Software Security practices for Architecture and Design - architectural risk analysis, Software security knowledge for Architecture and Design - Security principles, Security guidelines and Attack patterns.
Secure Coding and Testing:Introduction, Code analysis, Coding Practices, Software Security testing, Security testing considerations throughput the SDLC.

Module 4   SECURITY AND COMPLEXITY   *(10 Periods)*
System Assembly Challenges: Introduction, Security failures, functional and attacker perspectives for security analysis in web services and identity management, system complexity drivers and security, Deep technical problem complexity.

Module 5   GOVERNANCE AND MANAGING   *(10 Periods)*
Governance and Managing for more Secure Software: Introduction, Governance and security, adopting an enterprise software security framework, Defining adequate security, Risk Management framework for software security, Security and Project Management, Maturity of Practice.

Total Periods: 45

RESOURCES

TEXT BOOKS:
1. Julia H. Allen, Sean Barnum, Robert J. Ellison, Gary McGraw, and Nancy R. Mead,"Security Engineering: A Guide for Project Managers," Pearson Education, 2009.

REFERENCE BOOKS:
1. Gary McGraw, "Software Security: Building Security In," Addison
2. Mark Dowd, John McDonald and Justin Schuh, "The Art of Software Security Assessment: Identifying and Preventing Software Vulnerabilities," 1st Edition, Addison
3. John Viega and Gary McGraw, "Building Secure Software: How to Avoid Security Problems the Right Way," Addison
4. G. Hoglund and G. McGraw, "Exploiting Software: How to Break Code," Addison-Wesley, 2004.

VIDEO LECTURES:
1. Secure Software Engineering : Secure Design Principles & Coding Practices : https://youtu.be/teLmHBPGiV8
   Web Resources:
2. Essential Activities for Secure Software Development: https://www.researchgate.net/publication/340298331_Essential_Activities_for_Secure_Software_Development
3. **Understanding Software Architecture Vs. Software Security Design** : https://sopa.tulane.edu/blog/understanding-software-architecture-vs-software-security-design
4. A Governance Framework for Building Secure IT Systems :https://www.researchgate.net/publication/228404647_A_Governance_Framework_for_Building_Secure_IT_Systems

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101022	**QUANTUM COMPUTING**	3	-	-	-	3

Pre-Requisite Matrix Theory and Linear Algebra

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Introduction to Essential Linear Algebra, Some Basic Algebra, Overview of Quantum Physics Essentials, quantum architecture and design, Quantum Circuits Qubits, Quantum Gates, quantum algorithms, Current Asymmetric Algorithms and Asymmetric Cryptography, Specific Algorithms, Specific Applications

COURSE OUTCOME: After successful completion of the course, students will be able

CO1 Understand the Learn about quantum circuits and Essential Linear Algebra

CO2 Learn how to represent basic physics for quantum computing and perform gating operations on them.

CO3 Implementing and Analyzing Construct quantum circuits and quantum architecture quantum hardware

CO4 Understand particle Learn about quantum communication protocols and quantum algorithms, with important applications in security and cryptography

CO5 Utilize the principles of quantum Asymmetric Algorithms and Specific Applications

CO-PO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	3	1	-	-	-						
CO2	3	1	-	-	-	-	-	-	3	-						
CO3	3	1	3	-	-	-	-	-	-	1						
CO4	2	1								1						
CO5	3	-	-	-	-	3	1	-	-	-						
Course Correlation Mapping	3	1	3	-	-	3	1	-	3	1						

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT

Module 1: INTRODUCTION TO ESSENTIAL LINEAR ALGEBRA (09 Periods)

Introduction to Essential Linear Algebra: Some Basic Algebra, Matrix Math, Vectors and Vector Spaces, Set Theory. Complex Numbers: Definition of Complex Numbers, Algebra of Complex Numbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrices, Transcendental Numbers.

Module 2: BASIC PHYSICS FOR QUANTUM COMPUTING (09 Periods)

The Journey to Quantum, Quantum Physics Essentials, Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement. Basic Quantum Theory: Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD, Quantum Entanglement, Interpretation, QKE.

Module 3: QUANTUM ARCHITECTURE (09 Periods)

Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, The D-Wave Quantum Architecture. Quantum Hardware: Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.

Module 4: QUANTUM ALGORITHMS (09 Periods)

What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm. Grover's Algorithm

Module 5: CURRENT ASYMMETRIC ALGORITHMS (09 Periods)

RSA, Diffie-Hellman, Elliptic Curve. The Impact of Quantum Computing on Cryptography: Asymmetric Cryptography, Specific Algorithms, Specific Applications.

Total Periods: 60

EXPERIENTIAL LEARNING

LIST OF EXPERIMENTS:
1. Develop a basic building blocks of Quantum computers and highlight the paradigm change
2. Demonstration the Quantum state transformations and the algorithms
3. Create a simulationentangled quantum subsystems and properties of entangled states
4. Demonstration the applications of quantum computing
5. Demonstration the characteristics of Quantum Current Asymmetric Algorithms

RESOURCES

TEXT BOOKS:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press

2. Dr. Chuck Easttom, Quantum Computing Fundamentals, Pearson

REFERENCE BOOKS:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci

2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. Basic Concepts. Vol. Basic Tools and Special Topics, World Scientifi

3. Pittenger A. O., An Introduction to Quantum Computing Algorithms

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106101060 82 2.

2. https://www.cse.iitm.ac.in/course_details.php?arg=OTI 3.

3. https://swayam.gov.in/nd1_noc19_cs47/previ

WEB RESOURCES:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computerscience/6-046j-design-and-analysis-of-algorithms-spring-2015/ 2.

2. http://www.learnalgorithms.in/ 3. https://courses.cs.vt.edu/ csonline/Algorithms/Lessons/ 4.

3. http://openclassroom.stanford.edu/MainFolder/Course Page.php?course=IntroToAlgorithms.

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101017	**QUANTUM CRYPTOGRAPHY**	3	-	-	-	3

Pre-Requisite   Cryptography and Network Security

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION:
The goal of the course is to give you the ability to understand at a conceptual as well as technical level what makes quantum cryptography different and exiting; Starting with the basics of quantum information and cryptography we will study fundamental tasks in quantum cryptography: quantum money, the quantum one-time pad, secret sharing, nonlocal games, and two-party tasks such as bit commitment, coin-flipping and oblivious transfer

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Basic understanding about Quantum Information and Computation

CO2. Understand attack Strategies on QKD Protocols

CO3. Analyze and understand statistical analysis of QKD Networks in Real-Life Environment.

CO4. Apply Quantum-cryptographic networks.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	-	-	-	3	1	-	-	-
CO2	3	1	-	-	-	-	-	-	3	-
CO3	3	1	3	-	-	-	-	-	-	1
CO4	2	1								1
CO5	3	-	-	-	-	3	1	-	-	-
Course Correlation Mapping	3	1	3	-	-	3	1	-	3	1

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   Quantum Information Theory   *(09 Periods)*

Quantum Information Theory,Unconditional Secure Authentication, Entropy, Quantum Key Distribution, Quantum Channel, Public Channel, QKD Gain, Finite Resources

Module 2:   Adaptive Cascade Introduction   *(09 Periods)*

Adaptive Cascade Introduction,Error Correction and the Cascade Protocol, Adaptive Initial Block-Size Selection, Fixed Initial Block-Size, Dynamic Initial Block-Size, Examples

Module 3:   Attack Strategies on QKD Protocols: *(09 Periods)*

Introduction, Attack Strategies in an Ideal Environment, Individual Attacks in an Realistic Environment QKD Systems: Introduction, QKD Systems

Module 4:   Statistical Analysis of QKD Networks in Real-Life   *(09 Periods)*
**   Environment:**

Statistical Methods, Statistical Analysis QKD Networks Based on Q3P: QKD Networks, PPP, Q3P, Routing, Transport

Module 5:   Quantum-Cryptographic Networks from a Prototype   *(09 Periods)*
**   to the Citizen:**

The SECOQC Project, How to Bring QKD into the "Real" Life The Ring of Trust Model: Introduction, Model of the Point of Trust, Communication in the Point of Trust Model, Exemplified Communications, A Medical Information System Based on the Ring of Trust

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXPERIMENTS:

1   Write a Report on 'Quantum Money'

2   Quantum Oracle Interrogation

3   Quantum Merkle Puzzle

4   Implications of Quantum Technology on Trading and Financial Markets

5   Lower Bounds on Quantum Query Complexity

RESOURCES

TEXT BOOKS:

1. Kollmitzer C., Pivk M. (Eds.), Applied Quantum Cryptography, Lect. Notes Phys. 797 (Springer, Berlin Heidelberg 2010).

REFERENCE BOOKS:

1. Gerald B. Gilbert, Michael Hamrick, and Yaakov S. Weinstein, Quantum Cryptography, World Scientific Publishing.

2. Gilles Van Assche, Quantum Cryptography and Secret-Key Distillation, Cambridge University Press.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=ToOLbdrWst4

2. https://www.youtube.com/watch?v=aKNzbB6a3mQ

3. https://www.youtube.com/watch?v=_5NQf8k3Jo0

4. https://www.youtube.com/watch?v=dbP2cgTsrRo

5. https://archive.nptel.ac.in/courses/106/106/106106241/

Web Resources

1. https://www.etsi.org/technologies/quantum-safe-cryptography

2. https://www.ibm.com/topics/quantum-cryptography

3. https://quantumxc.com/blog/quantum-cryptography-explained/

4. https://cloud.ibm.com/docs/key-protect?topic=key-protect-quantum-safe-cryptography-tls-introduction

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101004	**SECURE CODING PRACTICES**	3	-	-	-	3

Pre-Requisite   Cyber Security Essentials
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course aims to provide an understanding of the various security attacks and knowledge to recognize and remove common coding errors that lead to vulnerabilities. It gives an outline of the techniques for developing a secure application

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Understand the basics of secure programming.
CO2. Apply the most frequent programming errors leading to software vulnerabilities.
CO3. Analyze security problems in software
CO4. Design and protect against security threats and software vulnerabilities
CO5. Develop and apply their knowledge to the construction of secure software systems
CO6. Interpret ethical principles in security and privacy in the areas of secure coding and follow in professional practice

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3	-
CO2	3	3	3	-	-	-	2	-	-	-	-	2	3	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	2	-	3	-	3	-
CO4	2	3	3	-	-	-	-	2	-	-	-	-	3	-	-	-
CO5	2	3	3	-	-	-	-		-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	3	-	-	-	2	3	-	-	2	2	3	-	3	-

Correlation Levels: 3: High;   2: Medium; 1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO SECURE CODING PRACTICES   *(10 Periods)*
Security, CIA Triad, Viruses, Trojans, and Worms In a Nutshell, Security Concepts-exploit, threat, vulnerability, risk, attack. Malware Terminology: Rootkits, Trapdoors, Botnets, Key loggers, Honeypots. Active and Passive Security Attacks. IP Spoofing, Tear drop,DoS, DDoS,XSS, SQL injection, Smurf, Man in middle, Format String attack. Types of Security Vulnerabilities- buffer overflows, Invalidated input, race conditions, access-control problems, weaknesses in authentication, authorization, or cryptographic practices. Access Control Problems.

Module 2:   NEED FOR SECURE SYSTEMS   *(08 Periods)*
 Proactive Security development process, Secure Software Development Cycle (S-SDLC), Security issues while writing SRS, Design phase security, Development Phase, Test Phase, Maintenance Phase, Writing Secure Code – Best Practices SD3 (Secure by design, default and deployment), Security principles and Secure Product Development Timeline.

Module 3   THREAT MODELING PROCESS AND ITS BENEFITS: (8 Periods)
Identifying the Threats by Using Attack Trees and rating threats using DREAD, Risk Mitigation Techniques and Security Best Practices. Security techniques, authentication, authorization. Defence in Depth and Principle of Least Privilege.

Module 4   SECURE CODING TECHNIQUES   (9 Periods)
 Protection against DoS attacks, Application Failure Attacks, CPU Starvation Attacks, Insecure Coding Practices In Java Technology. ARP Spoofing and its countermeasures. Buffer Overrun- Stack overrun, Heap Overrun, Array Indexing Errors, Format String Bugs. Security Issues in C Language: String Handling, Avoiding Integer Overflows and Underflows and Type Conversion Issues- Memory Management Issues, Code Injection Attacks, Canary based countermeasures using Stack Guard and Propolice. Socket Security, Avoiding Server Hijacking, Securing RPC, ActiveX and DCOM.

Module 5   DATABASE AND WEB-SPECIFIC ISSUES AND   (10 Periods)
**   TESTING SECURE APPLICATIONS**
Database and Web-specific issues: SQL Injection Techniques and Remedies,Race conditions, Time of Check Versus Time of Use and its protection mechanisms. Validating Input and Interprocess Communication, Securing Signal Handlers and File Operations. XSS scripting attack and its types – Persistent and Non persistent attack XSS Countermeasures and Bypassing the XSS Filters. Testing Secure Applications: Testing HTTP-Based Applications, Testing File-Based Applications, Testing Clients with Rogue Servers.

Total Periods: 45

RESOURCES

TEXT BOOKS:
1. Michael Howard and David LeBlanc,"Writing Secure Code", 2nd edition Microsoft Press,2015.
2. Jason Deckar,"Buffer Overflow Attacks: Detect, Exploit, Prevent",1st edition , Syngress publishers, 2005.

REFERENCE BOOKS:
1. Frank Swiderski and Window Snyder," Threat Modeling",1st edition, Microsoft Press, 2004.

VIDEO LECTURES:
1.   https://www.coursera.org/learn/secure-coding-principles
2.   https://www.udemy.com/course/secure-coding-secure-application-development
3.   https://www.coursera.org/specializations/secure-coding-practices

WEB RESOURCES:
1.   https://snyk.io/learn/secure-coding-practices
2.   https://owasp.org/www-project-secure-coding-practices-quick-reference

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101005	**MOBILE APPLICATION SECURITY**	3	-	-	-	3

Pre-Requisite   Cyber Security Essentials
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion on Mobile Issues and Development Strategies. It cover major security issues and solutions in various mobile operating systems like symbiont, Andriod and Ios. The course covers the concept of bluetooth security and SMS security in a broad way.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Understand mobile security issues and application development strategies.
CO2. Develop security models for Android,iOS and windows operating systems.
CO3. Evaluate security mechanism in symbian operating system.
CO4. Apply security principles for Web OS and mobile security services
CO5. Understand the concepts of Bluetooth and SMS security
CO6. Interpret ethical principles in security and privacy in the areas of mobile applications and follow in professional practice

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	2	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	2	-	2	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	2	-	2	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-	2	-	2	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	-	2	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	3	2	-	-	-	3	-	-	-	-	2	-	2	-

Correlation Levels: 3: High;   2: Medium;1: Low

COURSE CONTENT:
Module 1:   MOBILE ISSUES AND DEVELOPMENT STRATEGIES   (09 Periods)
Issues facing Mobile devices, Securing mobile application development Android Security: Android Securable IPC Mechanism, Android Security Model, Intents, Activities, Services, Android Security tools.

Module 2:   APPLE IPHONE & WINDOWS MOBILE SECURITY   (10 Periods)
Apple iPhone: iPhone Development environment, Security testing, Application format, permissions and user control, Local data storage, Networking, Push notifications
 Windows Mobile Security: Introduction to Windows Mobile platform, Kernel Architecture, Development and security testing, Permissions and user control, Local data storage, Networking.

Module 3:   SYMBIAN OS SECURITY   (07 Periods)

Introduction to Platform, Development and security testing, Code Security, Application Packaging, Permissions and user control, Inter process Communication, Persistent data storage.

Module 4:   WEB OS SECURITY & MOBILE SERVICES   *(10 Periods)*
WebOS Security: Introduction to the Platform, Development and Security Testing, Code Security, Permissions and User Controls.
Mobile Services: WAP and Mobile HTML Security, WAP and Mobile HTML Basics, Authentication on WAP/Mobile HTML Sites, Encryption, Application Attacks on Mobile HTML Sites, WAP and Mobile Browser Weaknesses.

Module 5:   BLUETOOTH SECURITY & SMS SECURITY   *(09 Periods)*
Bluetooth Security: Overview of the Technology, Bluetooth Technical Architecture, Bluetooth Security Features, Threats to Bluetooth Devices and Network, Bluetooth Vulnerabilities.
SMS Security: Overview of Short Message Service, Overview of Multimedia Messaging Service, Protocol Attacks, Application Attacks, Walkthroughs.

Total Periods: 45

EXPERIENTIAL LEARNING:

1.   the Android security mechanism with the help
     of the Bauhaus tool-suite.
     the Android security mechanism with the help
     of the Bauhaus tool-suite.
     the Android security mechanism with the help
     of the Bauhaus tool-suite.
     Prepare a case study on Mobile device security and other threats.
2.   Prepare a case study on Security Evaluation of the Windows Mobile Operating System.
3.   Prepare a case study on Android security mechanism with the help of the Bauhaus tool suite.

RESOURCES

TEXT BOOKS:
1.   Mobile Application Security, HimanshuDwivedi, Chris Clark, David Thiel, Tata McGraw Hill, 1st Edition, 2010.
2.   Hacking Exposed Mobile Security Secrets &Solutions ,Neil Bergman, Mike Stanfield, Jason, Rouse , Joel Scambray , SarathGeethakumar , SwapnilDeshmukh, Scott Matsumoto , John Steven , Mike Price, McGraw-Hill Osborne Media,1st Edition ,2013.

REFERENCE BOOKS:
1.   Mobile Device Security: A Comprehensive Guide to Securing Your Information in a Moving World, Stephen Fried, Auerbach Publications,1st Edition,2010.
2.   Mobile Device Security for Dummies, RichaCampagna, SubbuIyer, Ashwin Krishnan, Mark Bauhas,Wiley, 1st Edition, 2011.

VIDEO LECTURES:
1.   https://onlinecourses.swayam2.ac.in/nou23_ge24/preview
2.   https://www.coursera.org/learn/introduction-to-ios-mobile-application-development

WEB RESOURCES:
1.   https://owasp.org/www-project-mobile-app-security/
2.   https://www.appknox.com/
3.   https://www.immuniweb.com/mobile/

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101006	**SYSTEM SECURITY**	3	-	2	-	4

Pre-Requisite Computer Networks
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussiononIntroduction to computer security; Operating System Security Models, Unix Security, Windows Security, Storage & Database Security, Wireless Network Security

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1: Apply cryptographic techniques and network protocols for administrative security.
CO2: Understand operating system security models and secure Windows and Unix Operating Systems.
CO3: Apply mechanisms for securing data and applications.
CO4: Apply security mechanisms for wireless intrusion detection and prevention.
CO5: Apply infrastructure services for securing E-mail, web servers, DNS servers and Proxy servers.
CO6: Work independently and in teams to solve System Security problems with effective communications
CO7. Interpret ethical principles in security and privacy in the areas of system security applications and follow in professional practice

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	2	-	-	-	-	-	-	-	3	3	3	2
CO2	3	2	3	-	-	-	-	-	-	-	-	-	3	3	3	-
CO3	3	2	3	2	2	-	-	-	-	-	-	-	3	3	3	2
CO4	3	2	3	2	2	-	-	-	-	-	-	-	3	3	3	2
CO5	3	2	2	2	2	-	-	-	-	-	-	-	3	3	3	2
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
CO7	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	2	3	2	2	-	-	3	3	3	-	-	3	3	3	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION **(09 Periods)**
Computer Security, Threats, Administrative Security, Overall Planning and Administration, Day to Day Administration, About the Internet, Network Protocols, Encryption: DES, AES, RSA.

Module 2: COMPUTER SECURITY **(08 Periods)**
Operating System Security Models: Operating System Models, Classic Security Models, Reference Monitor, Trustworthy Computing, International Standards for Operating System Security.

Unix Security: Securing a Unix System, Place Servers into Network Zones, Authentication Processes, Limit the Number of Administrators and Privileges, Back Up the System, Security Lists.
Windows Security: Securing Windows Systems, Active Directory Domain Architecture.

Module 3: Data Security   (08 Periods)
Storage Security: Storage Security Evolution, Modern Storage Security, Risk Remediation.
Database Security: General Database Security Concepts, Understanding Database Security Layers, Understanding Database-Level Security, Application Security, Database Backup and Recovery, Keeping servers Up to Date, Database Auditing and Monitoring.

Module 4: WIRELESS NETWORK SECURITY   (10 Periods)
Radio Frequency Security Basics, Data-Link Layer Wireless Security Features, Flaws, and Threats, Wireless Vulnerabilities and Mitigations, Wireless Network Hardening Practices and Recommendations, Wireless Intrusion Detection and Prevention, Wireless Network Positioning and Secure Gateways.

Module 5: SECURING INFRASTRUCTURE SERVICES   (10 Periods)
E-Mail: Protocols Their Vulnerabilities and Counter measures, Spam and Spam Control
Web Servers: Types of Attacks, Web Server Protection
DNS Servers: Prevent Unauthorized Zone Transfers, DNS Cache Poisoning
Proxy Servers: HTTP, FTP, Direct Mapping, POP3, Reverse Proxy
                                                          Total Periods: *45*
EXPERIENTIAL LEARNING
LIST OF EXERCISES:
1	a	Implement DES algorithm for the given input parameters
	b	Implement AES algorithm for the given input parameters
2	a	Implement RSA algorithm for the given input parameters.
	b	Using RSA asymmetric cryptographic algorithm demonstrate values for Private and Public Keys in cryptographic systems
3		Implement Firewall Configuration and generate Assessment-iptables using command arguments.
4		Configure and use SSH software to establish and experiment with secure connection and detect MITM attacks (impostors) with PuTTY.
5		Write a program to Demonstrate DNS Message format for resolver library routine
6		Simulate buffer overflow attack and protect against SQL injection attack.
7		Implement Brute force and dictionary attacks to generate passwords and hashes for files created in system.
8	a	Demonstrate installation and working of Intrusion detection System (IDS)using SNORT Tool
	b	Detect and record anomalous traffic and analyze Snort alert file using SNORT Tool
9	a	Configure Snort as detection engine detecting attacks based on signatures defined by rulesets.
	b	Create simple Snort rules.
10	a	Install, configure, and experiment with a honeypot to detect, capture, and analyze attacks.
	b	Create simple honeypot scenarios and alerts, and test them with test attacks

SOFTWARE/TOOLS:
- JAVA/PYTHON
- SNORT Tool

TEXT BOOKS:
1. Rick Lehtinen, " Computer Security Basics ",O'Reilly Media, Second Edition , 2006.
2. Mark Rhodes-Ousley, "Information Security ", McGraw-Hill Obsorne Media, Second Edition, 2013.

REFERENCE BOOKS:

1. Craighead, Geoff. High-Rise Security and Fire Life Safety. Butterworth-Heinemann, 2003.
2. Fennelly, Lawrence J. Effective Physical Security. Butterworth-Heinemann, 1997.
3. Matchett, Alan R. CCTV for Security Professionals. Butterworth-Heinemann, 2003.

VIDEO LECTURES:
1. **https://onlinecourses.nptel.ac.in/noc22_cs36/preview**

WEB RESOURCES:
1. https://www.geeksforgeeks.org/system-security
2. https://support.microsoft.com/en-us/windows/

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB102008	**WEB APPLICATION SECURITY**	3	-	2	-	4

Pre-Requisite   Web Technologies
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion onIntroduction to Web Application Security, Web application Vs Cloud application, Security Fundamentals, Authentication Fundamentals, Authorization, The Same-Origin Policy, Cross-Site Scripting, Database Security Principles, File Security Principles, The HTTP Protocol, Web Functionality, Encoding Schemes.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Identify the vulnerabilities in the web applications.
CO2. Identify the various types of threats and mitigation measures of web applications.
CO3. Apply the security principles in developing a reliable web application.
CO4. Use industry standard tools for web application security.
CO5. Apply penetration testing to improve the security of web applications.
CO6. Work independently and in teams to solve Data Science problems with effective communications
CO7. Interpret ethical principles in security and privacy in the areas of web applications and follow in professional practice

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	1	2	-	-	-	-	-	-	-	3	3	3	-
CO2	2	3	-	2	-	-	-	-	-	-	-	-	3	3	3	-
CO3	2	2	3	1	-	-	-	-	-	-	-	-	3	3	3	-
CO4	3	2	3	1	3	-	-	-	-	-	-	-	3	3	3	-
CO5	2	2	3	1	-	-	-	-	-	-	-	-	3	3	3	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-
CO7	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
Level of correlation of the course	3	4	3	1	3	-	-	3	3	3	-	-	3	3	3	-

Correlation Levels: 3: High   2: Medium   1: Low

COURSE CONTENT:
Module 1 - WEB APPLICATION SECURITY FUNDAMENTALS   (9 periods)
Introduction: Introduction history of web applications interface ad structure benefits and drawbacks of web applications, Web application Vs Cloud application.
Security Fundamentals: Input Validation, Attack Surface Reduction Rules of Thumb, Classifying and Prioritizing Thread

Module 2 –WEB APPLICATION SECURITY PRINCIPLES   (9 periods)
Authentication: Access Control Overview, Authentication Fundamentals, Two-Factor and Three-Factor Authentication, Web Application Authentication, Securing Password-Based

Authentication.
Authorization: Access Control Continued, Session Management Fundamentals, Securing Web Application Session Management

Module 3 –BROWSER SECURITY PRINCIPLES   (9 periods)
The Same-Origin Policy: Defining the Same-Origin Policy, Exceptions to the Same-Origin Policy, Final Thoughts on the Same-Origin Policy
Cross-Site Scripting: Cross-Site Scripting, Cross-Site Request Forgery, Final Thoughts on the Same-Origin Policy

Module 4 –DATABASE SECURITY AND FILE SECURITY   (9 periods)
Database Security Principles: Structured Query Language (SQL) Injection, Setting Database Permissions, Stored Procedure Security, Insecure Direct Object References.
File Security Principles: Keeping Your Source Code Secret, Security Through Obscurity, Forceful Browsing.

Module 5–WEB APPLICATION TECHNOLOGIES   (9 periods)
The HTTP Protocol: HTTP Requests, HTTP Responses, HTTP Methods, URLs, REST, HTTP Headers, Cookies, Status Codes, HTTPS, HTTP Proxies, HTTP Authentication.
Web Functionality: Server-Side Functionality, Client-Side Functionality, State and Sessions.
Encoding Schemes: URL Encoding, Unicode Encoding, HTML Encoding, Base64 Encoding, Hex Encoding.

Total periods: 45

EXPERIENTIAL LEARNING:
List of Exercises
1. Create two web pages one with mixed passive content and other with active   content.
2. Deploy these web pages on your web server deployed with SSL certificate.
3. Import the certificate into browser storage.
4. Access Firefox (your web page) URLs with HTTP.
5. Access Firefox (your web page) URLs with HTTPS.
6. Create a simple web form with password field.
7. Configure a Web server to support HSTS.
8. Use browser developer tools or (wget) to verify that HSTS header comes in the response.
9. Identify the websites that have implemented HSTS eg. Amazon.com. Access these websites with HTTP and verify their access is made with HTTPS and not with HTTP
10. Develop a JSON code to find a set of API endpoints found in a web application's API server.

RESOURCES

TEXT BOOKS:
1. Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw HillProfessional, 2011.
2. Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook: Finding andExploiting Security Flaws. John Wiley Sons, 2011.
REFERENCE BOOKS:
1. Andrew Hoffman. Web Application Security: Exploitation and Countermeasures for Modern Web Applications, O'Reilly Media, Inc., March 2020.
SOFTWARE/Tools Used:
HTTP, JavaScript, JSON, MySQL, and MongoDB

VIDEO LECTURES:
1. https://portswigger.net/web-security
2. *https://www.udemy.com/course/web-application-security*

WEBRESOURCES:
1. https://crypto.stanford.edu/cs155old/cs155-spring11/lectures/10-web
2. https://www.pentasecurity.com/wp-content/uploads/2020/05/Web-Security

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101007	**DATABASE AND WEB SECURITY**	3	-	-	-	3

Pre-Requisite: Database Management Systems, web technologies
Anti-Requisite:-
Co-Requisite:-

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Web Security Problem, Cryptographic Systems and Protocols; Privacy-Protecting Techniques, Securing Web Applications; Security models, Implementing VPDs; Secure DBMS architectures, Security mechanisms; Auditing Applications, SQL injection.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Design secure databases and communication of web applications by applying suitable tools and techniques.
CO2. Build Virtual Private Databases by assessing data dictionaries, policy managers and SQL server.
CO3. Analyze database server activities using oracle and SQL server.
CO4. Solve complex security problems of applications by using Preliminary analysis, requirement analysis and cryptographic protocols.
CO5. Defend privacy of applications by implementing privacy protection techniques.
CO6. Interpret ethical principles in security and privacy in the areas of web and database applications and follow in professional practice.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2	3
CO2	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2	3
CO3	3	2	3	2	2	-	-	-	-	-	-	-	3	2	2	3
CO4	3	2	3	2	2	-	-	-	-	-	-	-	3	2	2	3
CO5	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2	3
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	2	2	2	2	-	-	3	-	-	-	-	3	2	2	3

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: **SECURITY MODELS AND VIRTUAL PRIVATE DATABASES** *(09 Periods)*
Database Application Security Models: Introduction, Types of users, Security models, Application types, Application security models.
Virtual Private Databases: Introduction, Overview of VPD, Implementing VPDs, Implementing Oracle VPD, Viewing VPD Policies and application context using the data dictionary and policy manager, Implementing row and column level security with SQL server.

Module 2: **DATABASE SECURITY DESIGN** *(09 Periods)*
Secure DBMS Design: Introduction, Security mechanisms in DBMSs, Secure DBMS architectures.
Design of Secure Databases: Preliminary analysis, Requirement analysis and security policy selection, Conceptual design, Logical design, Physical design, Implementation of

security mechanisms, Verification, and testing.

Module 3: **DATA AUDITING AND AUDITING DATABASE** *(09 Periods)*
ACTIVITIES

Application Data Auditing: Introduction, DML action auditing architecture, Oracle triggers, SQL server triggers, Fine grained auditing with Oracle, DML statement audit trail, Auditing application errors with Oracle.

Auditing Database Activities: Using Oracle database activities, Creating DLL triggers with Oracle, Auditing database activities with Oracle, Auditing server activity with Microsoft SQL server 2000, Implementing AQL profiler, Security auditing with SQL server, SQL injection.

Module 4: **THE WEB SECURITY** *(09 Periods)*

The Web Security Problem, Risk Analysis and Best Practices, Cryptography and the Web: Cryptography and Web Security, Working Cryptographic Systems and Protocols, Legal Restrictions on Cryptography, Digital Identification; Top 10 vulnerabilities in OWAS

Module 5: **THE WEB PRIVACY** *(09 Periods)*
The Web's War on Your Privacy, Privacy-Protecting Techniques, Backups and Antitheft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Implement Secure coding for buffer flow heap attacks.
2. Implementation of Design methods to break authentication schemes
3. Implementation of methods for abusing Design Deficiencies against web sites
4. Design a method to simulate the HTML injections and cross-site scripting (XSS) to exploit the attackers.
5. Determine HTML injection bugs and possible measures to prevent HTML injection exploits.
6. Determine SQL injection and possible measures.
7. Creation and manipulation of database using SQL scripts and graphical interfaces.
8. Implementing DAC (Discretionary Access Control): Implementation of database security policies using DAC in oracle 10g/SQL server
9. Implementing of MAC (Mandatory Access Control) to ensure confidentiality and control information flow using either Oracle 10g or SQL server.
10. Implementation of Virtual Private Database using View using Oracle 10g or SQL server

RESOURCES

TEXT BOOKS:
1. Hassan A. Afyouni, *Database Security and Auditing: Protecting Data Integrity and Accessibility*, Cengage Learning, 2006.
2. Simson G. Arfinkel, Gene Spafford, *Web Security, Privacy and Commerce*, O' Reilly Media, 2nd edition 2001.

REFERENCE BOOKS:
1. Ron Ben Natan, *Implementing Database Security and Auditing, Elsevier Digital Press*, 2005.
2. S. Castano, M. Fugini, G. Martella, P. Samarati, *Database Security, Addison Wesley*, 1994.
3. Michael Gertz, SushilJajodia, *Handbook on Database security applications and trends*, Springer, 2008.
4. Bret Hartman, Donald J. Flinn, Konstantin Beznosov, Shirley Kawamoto, *Mastering Web Services Security*, John Wiley & Sons, Inc, 2003.

SOFTWARE/TOOLS:
1. Java (JDK 1.6 above version), SQL Server and oracle 10g

VIDEO LECTURES:
1. https://www.youtube.com/watch?v=i0ruuJ8znYo
2. https://www.youtube.com/watch?v=yuPvoPAlhV4
3. https://www.youtube.com/watch?v=ADaz876BkP4
4. https://www.youtube.com/playlist?list=PL1y1iaEtjSYiiSGVlL1cHsXN_kvJOOhu-
5. https://www.youtube.com/watch?v=6wJ9wYOmIEE

WEB RESOURCES:
1. Security Models and Virtual Private Databases - https://web.stanford.edu/dept/itss/docs/oracle/10gR2/network.102/b14266/apdvpoli.htm
2. Database Security Design - https://www.ibm.com/in-en/cloud/learn/database-security
3. Data Auditing and Auditing Database Activities- https://docs.oracle.com/cd/E18283_01/server.112/e10575/tdpsg_auditing.htm#:~:text=Auditing%20is%20the%20monitoring%20and,and%20network%20and%20multitier%20activities.
4. Web Security - https://developer.mozilla.org/en-US/docs/Web/Security
5. Web Privacy - https://ethics.csc.ncsu.edu/privacy/web/study.php

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101008	**DIGITAL WATERMARKING AND STEGANOGRAPHY**	3	-	-	-	3

Pre-Requisite	Cryptography and Network Security
Anti-Requisite	-
Co-Requisite	-

COURSE DESCRIPTION: This course provides a detailed discussion on fundamentals of watermaking and steganography, Coding and Encoding, Watermarking types, Watermarking techniques, steganography approaches and applications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Demonstrate knowledge on digital watermarking, steganography and threat model.
CO2. Analyze various coding techniques and watermaking types to embed watermarks into multimedia data.
CO3. Apply watermarking techniques and protocols to design applications for secure data transmission.
CO4. Apply multimedia encryption and stegnography approaches for multimedia authentication.
CO5. Identify various applications of watermaking and stegnography.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	2	2	2
CO2	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2	2
CO3	3	2	3	2	2	-	-	-	-	-	-	-	3	2	2	2
CO4	3	2	3	2	2	-	-	-	-	-	-	-	3	2	2	2
CO5	3	2	2	3	2	-	-	-	-	-	-	-	3	2	2	2
Course Correlation Mapping	**3**	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**2**	**2**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT
Module 1:   **INTRODUCTION**   *(09 Periods)*
Information Hiding, Digital Watermarking and Steganography, need of watermarking, Ownership Assertion, Properties of Watermarking Systems, Fundamental Issues, Information Hiding Methods, threat model.

Module 2:   **DIGITAL WATERMARKING**   *(08 Periods)*
Models of Watermarking, Basic Message Coding, Error Correction Coding Watermarking Encoding and decoding, Classification, Robust Watermarks, Fragile Watermarks, Additive Watermarks, advantage and disadvantage of watermarking.

Module 3:   **DIGITAL COMMUNICATION AND PROTOCOLS**   *(10 Periods)*

Mutual Information and Channel Capacity, Spread Spectrum Watermarking, Block DCT-domain Watermarking, Watermarking with Side-Information (Dirty-paper Coding), Improved Spread Spectrum Watermarking, Affine-Resistant Watermarking, Media Specific Digital Watermarking Image Watermarking, Video Watermarking, Audio Watermarking, Watermarking for CG-models Watermarking for Binary Images Watermarking for 3D Contents Data Hiding through watermarking techniques, A Buyer-Seller Watermarking, Extensions of Watermarking Protocols, Protocols for Secure Computation.

Module 4: WATERMARKING SECURITY AND STEGANALYSIS *(10 Periods)*
Cryptography and Multimedia Encryption, Multimedia Processing in the Encryption Domain, Privacy preserving Information Processing, Authentication of Multimedia (issues and challenges), Techniques for Authentication, content authentication.
Foundations of Steganography - Introduction to Steganalysis, the Building Blocks, Notation and Terminology, Steganographic Methods, Steganalysis Scenarios, Significant Steganalysis Algorithms.

Module 5: APPLICATIONS *(8 Periods)*
Applications of Digital Watermarking, Broadcast Monitoring, Owner Identification, Proof of Ownership, Transaction Tracking, Applications of Steganography, Steganography for Dissidents, Steganography for Criminals.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Develop an application to embed a watermark into an Image for proof of ownership using wavelets.
2. Design and develop an application to hide/extract information into/from an Image for secret data transmission using steganography.

RESOURCES

TEXT BOOKS:

1. Digital Watermarking and Steganography, Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, and Ton Kalker. 2nd Edition, Morgan Kaufmann Publishers, 2008.
2. Ingemar Cox, Matthew Miller, Jeffrey Bloom, and Jessica Fridrich . Digital Watermarking and Steganography, 2nd Ed, (The Morgan Kaufmann Series in Multimedia Information and Systems). (Hardcover – Nov 16, 2007)

REFERENCE BOOKS:
1 Frank Y. Shih. Digital Watermarking and Steganography: Fundamentals and Techniques, CRC Press.
2. Stefan Katzenbeisser, Fabien, and A.P. Petitcolas. Information Hiding Techniques for Steganography and Digital Watermarking, Artech House.
3. Neil F. Johnson; Zoran Duric; Sushil Jajodia. Information Hiding: Steganography and Watermarking – Attacks and Countermeasures, Springer. 5. Gregory Kipper. Investigator's Guide to Steganography, Auerbach Publications.

VIDEO LECTURES:
1. https://www.youtube.com/watch?v=O2RwWHWHQlM
2. https://www.youtube.com/watch?v=Te8Cao2Smsk

WEB RESOURCES:
1. https://www.sciencedirect.com/book/9780123725851/digital-watermarking-and-steganography
2. http://wiki.cas.mcmaster.ca/index.php/Steganography_and_Digital_Watermarking

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101009	**BLOCK CHAIN TECHNOLOGIES**	3	-	-	-	3

Pre-Requisite   Cryptography and Network Security
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion onIntroduction to Blockchain Technologies and its decentralization concepts, Digital Currencies, Smart Contracts, Ethereum, Hyperledger, Alternative Blockchains, Current Challenges and Scope of Research.

COURSE OUTCOMES: *After successful completion of this course, the students will be able to:*
CO1. Analyze the concepts of distributed systems, decentralization and blockchains in the Blockchain ecosystem.
CO2. Devise suitable Blockchain platforms for scalable applications.
CO3. Assess the challenges, trending technologies for understanding the research scope in Blockchain technologies.
CO4. Pertain to ethical and legal usage of Blockchain applications.
CO5. Formulate secured and sustainable Blockchains for healthy and safe society.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2	2
CO2	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2	2
CO3	3	2	3	2	2	-	-	-	-	-	-	-	3	2	2	2
CO4	3	2	3	2	2	-	-	-	-	-	-	-	3	2	2	2
CO5	3	2	2	3	2	-	-	-	-	-	-	-	3	2	2	2
Course Correlation Mapping	**3**	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**2**	**2**

Correlation Levels: **3: High;**   **2: Medium;**   **1: Low**

COURSE CONTENT:
Module-1: INTRODUCTION TO BLOCKCHAIN AND DECENTRALIZATION (09 Periods)
Introduction to Blockchain: Distributed systems, History of Blockchain, Introduction to Blockchain - Definitions, Generic elements, Features, Applications, Tiers; Types of Blockchain, CAP theorem and Blockchain, Benefits and limitations of Blockchain technology.

Decentralization: Decentralization using Blockchain, Decentralization methods and routes, Full ecosystem decentralization, Smart contract, Decentralized organizations, Decentralized autonomous organizations, corporations and societies, Applications and platforms for decentralization.

Module-2: DIGITAL CURRENCY – BITCOIN   **(09 Periods)**
Definitions, Transactions – Life cycle, Structure, Types; Blockchain – Structure of block and block header, Genesis block, Bitcoin network, Wallets; Bitcoin Payments – Investment and buying and selling bitcoins, Installation; Bitcoin Limitations, Namecoin.

Module-3: SMART CONTRACTS AND ETHEREUM   **(11 Periods)**

Smart Contracts: History & definition, Ricardian contracts - Smart contract templates, Oracles, Smart Oracles, Deployment of smart contracts on Blockchain.

Ethereum: Introduction, Ethereum Blockchain, Elements of Ethereum Blockchain, Precompiled contracts, Accounts, Block, Ether, Messages, Mining – Ethash, CPU and GPU mining; Clients and wallets, Ethereum Network, Applications developed on Ethereum, Scalability and security issues.

Module-4: HYPERLEDGERS AND ALTERNATIVE BLOCKCHAINS   **(08 Periods)**

Hyperledgers: Projects, Hyperledger as protocol, Fabric, Hyperledger Fabric, Sawtooth Lake, Corda.

Alternative Blockchains: Blockchains - Kadena, Stellar, Rootstock, Quorum, Tezos, Storj, Maidsafe, BigChainDB, Multichain, Tendermint; Platforms - BlockApps, Eris.

Module-5: CHALLENGES AND EMERGING TRENDS   **(08 Periods)**

Current Challenges: Scalability - Block size increase, block internal reduction, Invertible Blooms lookup tables, Sharding, State channels, Private Blockchain, Proof of stake; Privacy - Indistinguishability obfuscation, Homomorphic encryption, Zero knowledge proofs, State channels, Secure multiparty computation, Usage of hardware to provide confidentiality, Coinjoin, Confidential transactions, MimbleWimble; Security - Smart Contract Security.

Emerging Trends: Emerging trends, Improvement proposals, Blockchain Research - Smart contracts, Centralization issues, Limitations in cryptographic functions, Consensus algorithms, Scalability, Code obfuscation.

                                        Total Periods: 45

EXPERIENTIAL LEARNING:

1. Prepare a report on the application of Block chain technology for Healthcare.

2. Demonstrate the usage of Block chain Technologies for Supply Chain Management.

3. Prepare a report on Block Chain Technology for Copyrights.

4. Demonstrate how Security is ensured in IoT with Block chain Technology.

RESOURCES:

TEXT BOOKS:
1. Imran Bashir, *Mastering Blockchain: Deeper Insights into Decentralization, Cryptography, Bitcoin, and Popular Blockchain Frameworks*, Packt Publishing, 1st Edition, 2017.

REFERENCE BOOKS:
1. Arshdeep Bahga, Vijay Madisetti, *Blockchain Applications: A Hands-On Approach*, VPT Books, 2017.
2. Josh Thompson, *Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming*, Create Space Independent Publishing Platform, 2017.

VIDEO LECTURES:
1. https://nptel.ac.in/courses/106105184/
2. https://www.coursera.org/lecture/introduction-blockchain-technologies/

WEB RESOURCES:
1. https://medium.com/moatcoin/part-6-blockchain-simplified-notes-nptel-892f13875555
2. http://www.hands-on-books-series.com/assets/Bahga-Madisetti-Blockchain-Book-Code.zip

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101010	**MACHINE LEARNING FOR CYBER SECURITY**	3	-	-	-	3

Pre-Requisite   Cyber Security Essentials and Machine Learning
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion on Machine Learning concepts,quick way to detect anomalies, malware analysis and network traffic analysis by extracting used information, Examining how attackers exploit consumer-facing websites and app functionality and building machine learning based models to create a production system.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1.   Demonstrate knowledge on cyber security and machine learning Concepts.
CO2.   Analyze Anomaly Detection methods for building secure system.
CO3.   Select and apply to Perform malware and Network Traffic Analysis to build robust cyber system..
CO4.   Apply Security mechanisms for protecting consumer web.
CO5.   Apply Machine techniques for building secured validate production system

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	3	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	3	3	-
CO3	3	2	2	3	2	-	-	-	-	-	-	-	3	3	3	-
CO4	3	2	2	2	2	-	-	-	-	-	-	-	3	3	3	-
CO5	3	2	2	2	2	-	-	-	-	-	-	-	3	3	3	-
Level of correlation of the course	**3**	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**-**

Correlation Levels: 3: High   2: Medium   1: Low

COURSE CONTENT
**Module 1:   Convergence of Machine Learning and Cyber   *(09 Periods)*
                        Security**
Cyber Threat Landscape, The Cyber Attacker's Economy, Overview of Machine Learning, Real-World Uses of Machine Learning in Security, Spam Fighting: An Iterative Approach.
Classifying and Clustering: Training Algorithms to Learn, Supervised Classification Algorithms: Logistic Regression, Decision Trees, Decision Forests, Support Vector Machines, Naive Bayes ,k-Nearest Neighbors ,Neural Networks

**Module 2:   Anomaly Detection   *(07 Periods)*
Detection**: Anomaly Detection Versus Supervised Learning, Intrusion Detection with Heuristics, Data-Driven Methods, Feature Engineering for Anomaly Detection, Anomaly Detection with Data and Algorithms, Challenges of Using Machine Learning in Anomaly Detection.

Module 3   Malware Analysis and Network Traffic Analysis   *(11 Periods)*
Malware Analysis: Understanding Malware, Feature Generation, From Features to Classification, Live malware analysis, dead malware analysis, Android Malware Analysis.
Network Traffic Analysis: Theory of Network Defense, Machine Learning and Network Security, Building a Predictive Model to Classify Network Attacks

Module 4   Protecting the Consumer Web   *(09 Periods)*
Monetizing the Consumer Web, Types of Abuse and the Data That Can Stop Them, Supervised Learning for Abuse Problems, Clustering Abuse.

Module 5   Production Systems   *(09 Periods)*
Defining Machine Learning System Maturity and Scalability, Data Quality, Model Quality, Performance, Maintainability, Monitoring and Alerting, Security and Reliability.

Total Periods: 45

EXPERIENTIAL LEARNING
1. Anomaly detection using supervised learning algorithm like LOF(Local Outlier factor)
2. Study and implement intrusion detection system using SVM(Support Vector Machines)
3. Live malware analysis using unsupervised learning algorithm
4. Study and implement clustering abuse using K-Means Algorithm

RESOURCES

TEXT BOOKS:
1. Clarence Chio, David Freeman "Machine Learning and Security", O'Reilly Media, Inc.ISBN: 9781491979907
2. SumeetDua, Xian Du. "Data Mining and Machine Learning in Cyber security", CRC Press, ISBN:978-1439839423

REFERENCE BOOKS:
1. Emmanuel Tsukerman, Machine Learning for Cybersecurity Cookbook, Packt Publishers, 2019
VIDEO LECTURES:
1. https://www.youtube.com/watch?v=cpCKhhV1wQU
2. https://www.youtube.com/watch?v=oBdB61A8Yt8

WEB RESOURCES:
1. Machine Learning for Cyber Security: Machine Learning and Security Protecting Systems with Data and Algorithms (Clarence Chio David Freeman) (z-lib.org)
2. https://cset.georgetown.edu/wp-content/uploads/Machine-Learning-and-Cybersecurity.pdf
3. https://www.geeksforgeeks.org/machine-learning-for-anomaly-detection/
4. https://www.malware-traffic-analysis.net/

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101011	**CLOUD SECURITY**	3	-	-	-	3

Pre-Requisite Cloud Computing
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course emphasizes on the security issues of cloud at the application and network level. It covers Threats and Vulnerabilities in Virtual Platforms and different strategies to maintain the security in the cloud. By the end of this course students will acquire basic knowledge on privacy issues and the iimpact of Cloud Computing on Corporate IT.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Analyze the security challenges associated with deployment and delivery models for securing cloud-based systems
CO2. Interpret the Virtualization Security over hypervisors and VM with understanding of Virtualization Management Servers.
CO3. Analyze security policies and processes by employing security management models, which can be utilized to protect the integrity of cloud-based systems.
CO4. Analyze identity and access management (IAM) practice for authentication, authorization, and auditing of the users accessing cloud services.
CO5. Develop solutions to detect, mitigate and prevent evolving legal, compliance and privacy issues arising from cloud-based systems.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	3	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	3	3	-
CO3	3	2	2	3	2	-	-	-	-	-	-	-	3	3	3	-
CO4	3	2	2	2	2	-	-	-	-	-	-	-	3	3	3	-
CO5	3	2	2	2	2	-	-	-	-	-	-	-	3	3	3	-
Level of correlation of the course	**3**	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**-**

Correlation Levels: 3: High   2: Medium   1: Low

COURSE CONTENT

(9 Periods)

Module 1:   SECURITY ISSUES IN THE CLOUD
Infrastructure Security: The Network Level: Ensuring Data Confidentiality and Integrity, Proper Access Control, Availability of Internet-Facing Resources, Replacing the Established Model of Network Zones and Tiers with Domains, Network-Level Mitigation.
The Application Level: Security Threats, DoS and EDoS, End User Security, Web Application Securities
Data Security and Storage: Aspects of Data Security Data Security Mitigation, Provider Data and Its Security

Module 2: VIRTUALIZATION SECURITY *(9 Periods)*
Threats and Vulnerabilities in Virtual Platforms, Securing Hypervisors: ESXi, Hyper-V
Virtualization Management: Network Architecture, VMware vCenter, Virtual Machine Manager
Securing the VM: Stealing Guests, Cloud VM Reconnaissance, Virtual Disk Manipulation,
Virtual Machine Encryption, Locking down VMware VMs.

Module 3: SECURITY MANAGEMENT IN THE CLOUD *(9 Periods)*
Identity and Access Management: Trust Boundaries and IAM, IAM Challenges, Relevant
IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud
Authorization Management
Security Management in the Cloud: Security Management Standards, Security
Management in the Cloud, Availability Management: SaaS, PaaS, IaaS, Security Vulnerability,
patch and Configuration Management

Module 4 PRIVACY ISSUES *(9 Periods)*
Privacy Issues: Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud,
Protecting
Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud
Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws
and Regulations

Module 5 AUDIT AND COMPLIANCE *(9 Periods)*
Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Control Objectives,
Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance
Security-as-a-[Cloud] Service: Email filtering, Web Content filtering, Vulnerability
Management, Identity Management as a Service
Impact of Cloud Computing on Corporate IT: Potential Threats of using CSP's, **Case
Study:** Potential Changes in the IT Profession Caused by Cloud Computing
Total Periods: 45

RESOURCES

TEXT BOOKS:
1. Tim Mather, Subra Kumara swamy, Shahed Latif, *Cloud Security and Privacy: An
   Enterprise Perspective on Risks and Compliance,* O'Reilly Media,
2. Dave Shackleford, *Virtualization Security: Protecting Virtualized Environments,*
   Sybex , 2012

REFERENCE BOOKS:
1. Ronald L. Krutz, Russell Dean Vines*, Cloud Security,* Wiley
2. J.R. ("Vic") Winkler, *Securing the Cloud,* Syngress

VIDEO LECTURES:
1. https://nptel.ac.in/courses/106/105/106105167/
2. https://nptel.ac.in/courses/106/106/106106129/

WEB RESOURCES:
1. https://www.iare.ac.in/sites/default/files/lecture_notes/CC%20LECTURE%20NOTE
   S.pdf
2. https://resources.sei.cmu.edu/asset_files/presentation/2012_017_001_52439.pdf
3. https://www.tutorialspoint.com/cloud_computing/cloud_computing_security.html

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB104001	**CYBER FORENSICS AND INVESTIGATION**	3	-	2	4	5

Pre-Requisite   Cyber Security Essentials
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion on Introduction to Computer Forensics Evidence and Capture, Computer forensic analysis, Forensic Data Analysis, Mobile Device Security, Computer forensic cases and Computer Forensics Investigation Process.

COURSE OBJECTIVES:

- To impart knowledge on comprehensive understanding of digital forensic principles and the collection, preservation, and analysis of digital evidence.
- To enlighten the importance of forensic principles and procedures, legal considerations, digital evidence controls, and the documentation of forensic analysis.
- To develop an understanding of the different applications and methods for conducting network and digital forensic acquisition and analysis.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Demonstrate knowledge on computer forensics, collection and verification of digital evidence.
CO2. Perform computer forensic Analysis using digital evidence.
CO3. Perform Forensic Digital Analysis based on the legal issues.
CO4. Identify and analyze the potential Mobile forensic evidences.
CO5. Perform Computer Crime Investigation using Host and Network data.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	3	3	2
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	3	3	2
CO3	3	2	2	3	2	-	-	-	-	-	-	-	3	3	3	2
CO4	3	2	2	2	2	-	-	-	-	-	-	-	3	3	3	2
CO5	3	2	2	2	2	-	-	-	-	-	-	-	3	3	3	2
Level of correlation of the course	**3**	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**2**

Correlation Levels: 3: High   2: Medium   1: Low

COURSE CONTENT:
Module 1 - INTRODUCTION AND COMPUTER FORENSICS EVIDENCE AND CAPTURE

(9 periods)

Introduction: Computer Forensics Fundamentals – Types of Computer Forensics Technology – Types of Computer Forensics Systems –Vendor and Computer Forensics Services.

Computer forensics evidence and capture: Data Recovery – Evidence Collection and Data Seizure-Duplication and Preservation of Digital Evidence-Computer Image Verification and Authentication.

Module 2 – COMPUTER FORENSIC ANALYSIS   (9 periods)
Computer forensic analysis: Discover of Electronic evidence Identification of Data – Reconstructing Past Events – Fighting against Macro Threats – Information Warfare Arsenal – Tactics of the Military – Tactics of Terrorist and Rogues – Tactics of Private Companies

Module 3 – FORENSIC DATA ANALYSIS   (9 periods)
Information warfare: Arsenal – Surveillance Tools – Hackers and Theft of Components – Contemporary Computer Crime-Identity Theft and Identity Fraud – Organized Crime and Terrorism – Avenues Prosecution and Government Efforts – Applying the First Amendment to Computer Related Crime-The Fourth Amendment and other Legal Issues.

Module 4–MOBILE DEVICE SECURITY AND FORENSICS CASES   (9 periods)

Computer forensic cases: Developing Forensic Capabilities – Searching and Seizing Computer Related Evidence –Processing Evidence and Report Preparation – Future Issues.
Introduction to Mobile Forensic -Android Device - Analysis- Android Mal ware- iOS Forensic Analysis - SIM Forensic Analysis - Case study.

Module 5–COMPUTER FORENSICS INVESTIGATION PROCESS   (9 periods)
Introduction to Computer Crime Investigation: Initial Decision-Making Process, Assess the Situation: Notify Decision Makers and Acquire Authorization, Review Policies and Laws, Identify Investigation Team Members, conduct a Thorough Assessment, Prepare for Evidence Acquisition, Acquire the Data :Build Computer Investigation Toolkit, Preparing Your Organization for a Computer Investigation, Collect the Data, Store and Archive. Analyze the Data: Analyze Network Data, Analyze Host Data, Analyze Storage Media, Report the Investigation: Gather and Organize Information, Write the Report.

Total periods: 45
EXPERIENTIAL LEARNING:
1. Study of Computer Forensics and different tools used for forensic investigation.
2. Perform Recovery of Deleted Files using Forensics Tools
3. Identify and list the steps for h22CBiding and extract any text file behind an image file/ Audio file using Command Prompt.
4. Extract Exchangeable image file format (EXIF) Data from Image Files using Exifreader Software.
5. Prepare the forensic image of the hard drive using EnCaseForensics.
6. perform the Evidence Image Restoring using EnCase Forensics.
7. Collect the Email Evidence in Victim PC.
8. Extracting Browser Artifacts.
9. View Last Activity of Your PC
10. Find Last Connected USB on your system (USB Forensics)
11. Case study 1: Comparison of two Files for forensics investigation by Compare IT software
12. Case study 2: Live Forensics Case Investigation using Autopsy.
RESOURCES

TEXT BOOKS:
1) John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", Cengage Learning, 2nd Edition, 2005.
2) Marjie T Britz, "Computer Forensics and Cyber Crime: An Introduction", Pearson Education, 2nd Edition, 2008.

3) https://www.cemca.org/ckfinder/userfiles/files/Module%2002%20Computer%20Forensics%20Investigation%20Process.pdf

REFERENCE BOOKS:
1) MariE-Helen Maras, "Computer Forensics: Cybercriminals, Laws, and Evidence", Jones & Bartlett Learning; 2nd Edition, 2014.
2) Chad Steel, "Windows Forensics", Wiley, 1st Edition, 2006.
3) Majid Yar, "Cybercrime and Society", SAGE Publications Ltd, Hardcover, 2nd Edition, 2013.
4) Robert M Slade, "Software Forensics: Collecting Evidence from the Scene of a Digital Crime", Tata McGraw Hill, Paperback, 1st Edition, 2004

SOFTWARE/Tools Used:
1. An Intel-compatible platform running Windows 10 /8.1/8 /7 /Vista /XP /2000 Windows server 2019 /2016 /2012 /2008 /2003
2. Digital Forensic Tools:-The Sleuthkit Kit (TSK) , Helix ,Knoppix etc.
3. At least 256 MB of RAM, a mouse, and enough disk space for recovered files, image files, etc.
4. The administrative privileges are required to install and run Big Data utilities.
5. A network connection for data recovering over network.

VIDEO LECTURES:
1. https://youtu.be/PEL37Z9gbRQ https://youtu.be/bAyrObl7TYE
2. https://youtu.be/dnidcOJA-ow
3. https://youtu.be/pM8yX-cr6S8

WEB RESOURCES:
1. https://www.noxcivis.com/forensics/
2. https://null-byte.wonderhowto.com/how-to/hack-like-pro-digital-forensics-for-aspiring-hacker-part-3-recovering-deleted-files-0149868/
3. https://cenexp.com/biblioteca/librerias/FOR/Bforense/LF20.pdf
4. https://www.cisa.gov/sites/default/files/publications/forensics.pdf

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101012	**CYBER PHYSICAL SYSTEM SECURITY**	3	-	-	-	3

Pre-Requisite   Computer Networks
Anti-Requisite   -
Co-Requisite   -

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Understand and recognize instances of the principal attacks on cyber physical infrastructure networks
CO2. Analyze the possible attack models and solutions to tackle the cyber attacks.
CO3. Analyze architectures of complex CPS networks to build security models for an application
CO4. Apply the language and compiler techniques to analyze the behavior of cyber and physical attacks.
CO5. Identify the attacks by using tracking patterns of interest in security sensor streams

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	3	3	2
CO2	3	2	3	2	2	-	-	-	-	-	-	-	3	3	3	2
CO3	3	3	3	2	2	-	-	-	-	-	-	-	3	3	3	2
CO4	3	3	3	2	2	-	-	-	-	-	-	-	3	3	3	2
CO5	3	2	3	2	2	-	-	-	-	-	-	-	3	3	3	2
Level of correlation of the course	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**2**

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT:

Module 1:   SECURITY AND VULNERABILITY OF CYBER- *(10 Periods)*
PHYSICAL INFRASTRUCTURE NETWORKS
Definitions For Security And Vulnerability Of Network Dynamics, Differential Equation Models for Infrastructure Networks, Defining Security Measures for the Dynamical Network Example, Definitions of Vulnerability for Infrastructure Network Dynamics, Integrated Analysis: Prevention, Attack, and Mitigation Together, An Illustrative Example, Network Control Tools For Characterizing And Designing Security And Vulnerability, Tools for Network Inference

Module 2:   GAME THEORY FORINFRASTRUCTURE SECURITY   *(09 Periods)*
Motivation in Anomaly Detection, Motivation in Anonymous Communication Systems, Game Theory Basics, Anomaly Detection Basics, Anonymous Communication Basics, Intent-Based Adversary Model For Anomaly Detection, Intent-Based Adversary Model For Anonymous Communication Systems

**Module 3:   AN ANALYTICAL FRAMEWORK FOR CYBER-PHYSICAL   *(09 Periods)*
            NETWORKS**

Spatial Dispersion Models, A Hierarchy of Dispersion Model, An Analytical CPN Mode, Placement and Coverage Problems, Projective Space and Fusers, Bayesian and Empirical Estimation Methods, CPN Infrastructure Robustness, Robustness Based on Expectations, Intentional Compromises

(10 Periods)

Module 4:   SECURITY FOR SENSOR NETWORKS

Efficient and Distributed Access Control for Sensor Networks, Defending Against Physical Attacks in Wireless Sensor Networks, Node Compromise Detection in Wireless Sensor Networks

Platform Security: Hardware and Security: Vulnerabilities and Solutions, Languages and Security: Safer Software Through Language and Compiler Techniques

Cloud Computing and Data Security: Protecting Data in Outsourcing Scenarios, Data Security in Cloud Computing, Secure Mobile Cloud Computing, Relation Privacy Preservation in Publishing Online Social Networks

Module 5:   EVENT MONITORING AND SITUATION AWARENESS   *(07 Periods)*

Distributed Network and System Monitoring for Securing Cyber-Physical Infrastructure, Discovering and Tracking Patterns of Interest in Security Sensor Streams, Pervasive Sensing and Monitoring for Situational Awareness, Sense and Response Systems for Crisis Management

Security in Real-World Systems: Security and Privacy in the Smart Grid, Cyber-Physical Security of Automotive Information Technology, Security and Privacy for Mobile Health-Care (m-Health) Systems, Security and Robustness in the Internet Infrastructure

Total Periods: 45

EXPERIENTIAL LEARNING:

1. Prepare a detailed report on Resource Constraints in Cyber Physical Systems
2. Development and demonstration of quantum communication & cryptography.
3. CPS vulnerabilities, threats, attacks & failures
4. Demonstrate real -time CPS attacks.

RESOURCES

TEXT BOOKS:

1. Sajal K. Das, Krishna Kant, Nan Zhang, Morgan Kaufmann, "Handbook on Securing Cyber-Physical Critical Infrastructure", Elsevier Publication, 2012.
2. Houbing Song, Glenn A. Fink, Sabina Jeschke, "Security and Privacy in Cyber-Physical Systems: Foundations, Principles, and Applications", IEEE Press, 2017.

REFERENCE BOOKS:

1. Nina Godbole and SunitBelpure, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives" , Wiley publications.
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, "Computer and Cyber Security: Principle s, Algorithm, Applications, and Perspectives", CRC Press, 2018.

VIDEO LECTURES:

1.   https://www.coursera.org/lecture/iot-connectivity-security/introduction-to-cps-security-and-privacy-skRaa
2.   https://www.udacity.com/course/cyber-physical-systems-security--ud279

WEB RESOURCES:

1.   https://github.com/topics/cyber-physical-systems
2.   https://www.youtube.com/watch?v=eXGK0s8Kn18

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101013	**WIRELESS AND MOBILE SECURITY**	3	-	-	-	3

Pre-requisite: Mobile Computing
Co-requisite: -
Anti-requisite: -

Course Description: This course provides a detailed discussion on Security Issues in Mobile Communication, Security of Device, Network, and Server Levels, Application Level Security in Cellular Networks, and Data Center Operations.

Course Outcomes: *After successful completion of the course, the students will be:*
CO1. Understand the concepts of mobile communication and its security issues.
CO2. Understand the Device security, Network, and Server Levels security issues and counter measures.
CO3. Apply the Security and authentication Solutions to achieve the Application Level Security in Cellular Networks.
CO4. Apply security schemes to protect MANETs from the internal and external threats.
CO5. Identify Data Center security issues and cryptographic techniques for protecting the data.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	3	2	-
CO2	3	2	3	2	2	-	-	-	-	-	-	-	3	3	2	-
CO3	3	3	3	2	2	-	-	-	-	-	-	-	3	3	2	-
CO4	3	3	3	2	2	-	-	-	-	-	-	-	3	3	2	-
CO5	3	2	3	2	2	-	-	-	-	-	-	-	3	3	2	-
Level of correlation of the course	**3**	**3**	**3**	**2**	**2**	**-**	-	-	-	-	-	-	**3**	**3**	**2**	-

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT:

Module-1: SECURITY ISSUES IN MOBILE COMMUNICATION: **(09 Periods)**
Mobile Communication History, Security – Wired Vs Wireless, Security Issues in Wireless and Mobile Communications, Security Requirements in Wireless and Mobile Communications, Security for Mobile Applications, Advantages and Disadvantages of Application – level Security.

Module-2: SECURITY OF DEVICE, NETWORK, AND SERVER LEVELS: (09 Periods)
Mobile Devices Security Requirements, Mobile Wireless network level Security, Server Level Security. Application Level Security in Wireless Networks: Application of WLANs, Wireless Threats, Some Vulnerabilities and Attach Methods over WLANs, Security for 1G Wi-Fi Applications, Security for 2G Wi-Fi Applications, Recent Security Schemes for Wi-Fi Applications.

Module-3: APPLICATION LEVEL SECURITY IN CELLULAR NETWORKS: (09 Periods)

Generations of Cellular Networks, Security Issues and attacks in cellular networks, GSM Security for applications, GPRS Security for applications, UMTS security for applications, 3G security for applications, Some of Security and authentication Solutions.

Module-4: APPLICATION LEVEL SECURITY IN MANETS: **(09 Periods)**
MANETs, Some applications of MANETs, MANET Features, Security Challenges in MANETs, Security Attacks on MANETs, External Threats for MANET applications, Internal threats for MANET Applications, Some of the Security Solutions. Ubiquitous Computing, Need for Novel Security Schemes for UC, Security Challenges for UC, and Security Attacks on UC networks, Some of the security solutions for UC.

Module-5: DATA CENTER OPERATIONS: **(09 Periods)**
Security challenge, implement "Five Principal Characteristics of Cloud Computing, Data center Security Recommendations Encryption for Confidentiality and Integrity, Encrypting data at rest, Key Management Lifecycle, Cloud Encryption Standards.

RESOURCES

TEXT BOOKS:
1. Pallapa Venkataram, Satish Babu, "Wireless and Mobile Network Security", 1st Edition, Tata McGraw Hill, 2010.
2. Frank Adelstein, K.S.Gupta, "Fundamentals of Mobile and Pervasive Computing", 1st Edition, Tata McGraw Hill 2005.

REFERENCE BOOKS:
1. Randall k. Nichols, Panos C. Lekkas, "Wireless Security Models, Threats and Solutions", 1st Edition, Tata McGraw Hill, 2006.
2. Bruce Potter and Bob Fleck, "802.11 Security" , 1st Edition, SPD O'REILLY 2005.
3. James Kempf, "Guide to Wireless Network Security,. Wireless Internet Security – Architecture and Protocols", 1st Edition, Cambridge University Press, 2008.

VIDEO LECTURES:
- https://www.youtube.com/watch?v=Fblp90rn7ww
- https://www.youtube.com/watch?v=vnLvup1q3pk

WEB RESOURCES:
- https://www.specnt.com/blog/security/2021/october/mobile-and-wireless-security-explained/
- https://www.geeksforgeeks.org/securing-wireless-and-mobile-devices/

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101014	**IOT SECURITY**	3	-	-	-	3

PRE-REQUISITES: Internet of Things

COURSE DESCRIPTION: This course provides a detailed discussion on Introduction of IoT; Securing The Internet Of Things; Cryptographic Fundamentals for IoT; Identity & Access Management Solutions for IoT; Privacy Preservation And Trust Models for IoT; Cloud Security for IoT.

COURSE OUTCOMES: *After successful completion of the course, students will be able to*:
CO1. Demonstrate knowledge on Security issues of IoT.
CO2. Apply Cryptographic Principles for IoT Security.
CO3. Identify suitable Access Management Solutions for IoT.
CO4. Apply Privacy Preservation and Trust Models for IoT.
CO5. Demonstrate knowledge on Cloud Security for IoT*.*

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	2	2	2
CO2	3	2	3	2	2	-	-	-	-	-	-	-	3	2	2	2
CO3	3	2	3	2	2	-	-	-	-	-	-	-	3	2	2	2
CO4	3	2	3	2	3	-	-	-	-	-	-	-	3	2	2	2
CO5	3	2	2	3	3	-	-	-	-	-	-	-	3	2	2	2
Course Correlation Mapping	**3**	**2**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**2**	**2**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT:

Module-1: INTRODUCTION: SECURING THE INTERNET OF THINGS (9 periods)
Security Requirements in IoT Architecture, Security in Enabling Technologies, Security Concerns in IoT Applications; Security Architecture in the Internet of Things, Security Requirements in IoT, Insufficient Authentication/Authorization, Insecure Access Control, Threats to Access Control, Privacy, and Availability, Attacks Specific to IoT; Vulnerabilities, Secrecy and Secret-Key Capacity, Authentication/Authorization for Smart Devices; Transport Encryption; Attack & Fault trees

Module-2: CRYPTOGRAPHIC FUNDAMENTALS FOR IOT   (9 periods)
Cryptographic primitives and its role in IoT, Encryption and Decryption, Hashes, Digital Signatures, Random number generation, Cipher suites, key management fundamentals, cryptographic controls built into IoT messaging and communication protocols, IoT Node Authentication.

Module-3: IDENTITY & ACCESS MANAGEMENT SOLUTIONS FOR IOT (9 periods)
Identity lifecycle, authentication credentials, IoT IAM infrastructure; Authorization with Publish/Subscribe schemes; access control.

Module-4: PRIVACY PRESERVATION AND TRUST MODELS FOR IOT (9 periods)

Concerns in data dissemination, Lightweight and robust schemes for Privacy protection, Trust and Trust models for IoT, self-organizing Things, Preventing unauthorized access

Module-5: CLOUD SECURITY FOR IOT   **(9 periods)**

Cloud services and IoT - offerings related to IoT from cloud service providers, Cloud IoT security controls; An enterprise IoT cloud security architecture – New directions in cloud enabled IoT computing.

Total Periods: *45*

EXPERIENTIAL LEARNING:
1. Discuss privacy regulations and standards that apply to secure IoT systems and keeping stakeholder information private.
2. List and explain privacy challenges and mitigations for the IoT

RESOURCES:

TEXT BOOK:
1. Brian Russell, Drew Van Duren, *Practical Internet of Things Security*, Kindle Edition, 2016.

REFERENCE BOOK:
1. Fei Hu, *Security and Privacy in Internet of Things (IoTs)-Models, Algorithms, and Implementations*, CRC Press, 1st Edition, 2016

VIDEO LECTURES:
1. https://www.edx.org/course/cybersecurity-and-privacy-in-the-iot
2. https://in.coursera.org/learn/iot-cyber-security

WEB RESOURCES:
1. https://www.fortinet.com/resources/cyberglossary/iot-security
2. https://www.insiderintelligence.com/insights/iot-security

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101015	**CYBER RISK MANAGEMENT**	3	-	-	-	3

Pre-Requisite - Cyber Security Essentials
Anti-Requisite -
Co-Requisite -

Course Outcomes: After successful completion of the course, the student will be able to:
CO1. Understand the variety of IT components and Risk types.
CO2. Apply Asset evaluation methods and classify risks.
CO3. Apply threat modeling methods to provide security to assets.
CO4. Generate Risk assessment reports using Quantitative and Qualitative Analysis.
CO5. Apply security methods for risk identification and recovery for business continuity.

COURSE CONTENT:

Module-1: IT SYSTEMS: **(9 Periods)**
Information Systems - System components - network components - Risk management - What is Risk - profile - identification -assessment -Analysis -Response - Tolerance - Risk types - inherent risk - control risk - audit risk. -Security risk analysis - Advantages

Module- 2: IT ASSETS: **(9 Periods)**
Assets management - Identify Assets - Asset classification - Asset valuation - Binary Asset Valuation -Rank-Based Asset Valuation - Consensus Asset Valuation - Classification-Based Asset Valuation - others

Module- 3: CYBER THREAT: **(9 Periods)**
Threat management - Identifying Threats -Threat model - Threat attributes - Attack tree - STRIDE - DREAD - OCTAVE - CAPEC- Threat Statements- Technical Threats and Safeguards - Physical Threats and Safeguard - Human Threats to Physical Security - The RIIOT Method: Physical Data Gathering - Test Physical Security Safeguard.

Module - 4: RISK ASSESSMENT: **(9 Periods)**
Security Risk Assessment - Quantitative vs. Qualitative Analysis - Determining Risk - Creating Risk Statement - Security Risk Mitigation - Selecting Safeguard - Security Risk Assessment Reports - Report Structure.

Module- 5: BUSINESS CONTINUITY: **(9 Periods)**
Principles of Business continuity - Business Interruption Events – Business impact assessment – fire exposure analysis – functional analysis –compliance issues – Pre-Planning - Initial Response - Recovery - Identification of Recovery environment - Identification of Recovery Point - site and structures – Equipment and technology – documents and records electronic equipment and process equipment - Business continuity plans – crisis management plans –function restoration plans – disaster recovery plans – Incident Response Plan.

Total Periods:45

RESOURCES:
TEXT BOOKS:
1. Thomas L Norman., Risk analysis and Security counter measure selection, CRC press, 2010
2. Ariel Evans, Managing Cyber Risk, Routledge, 2019.

REFERENCE BOOKS:

1. Lee T Ostrom, Risk Assessment: Tools, Techniques, and Their Applications, Wiley 2019
2. Christopher Hodson,, Cyber Risk Management: Prioritize Threats, Identify Vulnerabilities and Apply Controls, Kogan, 2019
3. Richard.E Cascarino., Auditors guide to information system auditing, John Wiley and Sons, 2007

VIDEO LECTURES:
1. https://www.coursera.org/specializations/information-security
2. https://www.ncsc.gov.uk/collection/10-steps

WEB RESOURCES:
1. https://hyperproof.io/resource/cybersecurity-risk-management-process/
2.https://www.itgovernance.co.uk/cyber-security-risk-management

SPECIALIZATION ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101016	**INFORMATION SYSTEMS AUDITING AND ASSURANCE**	3	-	-	-	3

Pre-Requisite   Computer Networks
Anti-Requisite   -
Co-Requisite   -

COURSE DESCRIPTION: This course aims to provide the basic concepts in information systems security, including security technology and principles, software security and trusted systems, and IT security management and explains concepts related to various cryptographic tools.

COURSE OUTCOMES: *After successful completion of the course, students will be able to*:

CO1. Understand the requirements and mechanisms for identification and authentication.
CO2. Determine risks and exposures introduced by computer-based information systems.
CO3. List types of controls that may be used to reduce such risks to an acceptable level and design controls for a particular business situation.
CO4. Evaluate different controls -preventive, detective and corrective in a computerized environment.
CO5. Demonstrate the concepts and theories underlying Internet Banking and Operating Systems.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	2	3	2
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	2	3	2
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	2	3	2
CO4	2	3	3	3	3	-	-	-	-	-	-	-	3	2	2	2
CO5	2	3	3	3	3								3	2	2	2
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**3**	**2**

Correlation Levels: *3: High;*   *2: Medium; 1: Low*

COURSE CONTENT

Module 1:   **INTERNAL CONTROL AND INFORMATION SYSTEM**   *(8 Periods)*   **AUDIT**

Information System Audit and Assurance Overview – Characteristics of Assurance services, Types of Assurances services, Certified Information system auditor, Benefits of Audits for Organization, COBIT;

Need for Internal Control and Information system audit - Internal Control and Information system Audit - Internal Control, Detective control, Corrective Control, Computer Assisted Audit Tools and Techniques.

Module 2: **CONDUCTING INFORMATION SYSTEM AUDIT** *(09 Periods)*

Conducting Audit – Standard, practices and Guidelines, Audit planning, Risk Assessment, Information gathering techniques, Vulnerabilities, System security testing, Development of Security Requirements Checklist, conducting Audits for Banks, The Road Map for setting up Information System.

Module 3 **MANAGEMENT AND APPLICATION CONTROL** *(9 Periods)*
REVIEW
Management Control, Information System Management Architecture, Case Study: Setting upan Information Technology Framework for a Banking Organization using Information system, Introduction to Application System, Types of Application System, Web-based Applications—Thin Clients, The Importance of the Application System.

Module 4 **NETWORK SECURITY AND CONTROL** *(9 Periods)*

Network—A Tool for Sharing Resources, Classification & Topology, Cabling, Devices.
Controls: IP Network, Threats to the Network, Controls to Counter, Threats to Network Security, Router Controls, Firewall Controls, Internal Security.

Module 5 **RISKS AND CONTROLS** *(10 Periods)*
Internet Banking: Introduction to Web Technology, Issues Related to Web Technology, Delegation of Authority, Types of Internet Banking, Generic Architecture, Internet Banking in a Centralized & Distributed Environment.
Operating System: Introduction to Operating System, Types of Operating Systems, OS Capabilities, Functional Components of Operating System, OS Security.

Total Periods: 45

RESOURCES

TEXT BOOKS:
1. D. P. Dube, Ved Prakash Gulati, Information System Audit and Assurance, Tata McGraw- Hill Education, 2005.

REFERENCE BOOKS:
1. William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Pearson education
2 Martin Weiss and Michael G. Solomon, Auditing IT Infrastructures For Compliance (Information Systems Security & Assurance), Jones and Bartlett Publishers, Inc.

VIDEO LECTURES:
- https://www.coursera.org/learn/information-systems-audit
- https://www.youtube.com/watch?v=TsMkn35fC_g

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22EC101701	**AI IN HEALTHCARE**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Concepts of Artificial Intelligence (AI) in Healthcare; The Present State and Future of AI in Healthcare Specialties; The Role of Major Corporations in AI in Healthcare; Applications of AI in Healthcare.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understand the fundamental concepts of AI in Healthcare sector.

CO2 Analyse the present state and future of AI in Healthcare specialties for different scenarios.

CO3 Apply design concepts and metrics for AI in Healthcare.

CO4 Demonstrate basic concepts and terminologies of future applications of Healthcare in AI.

CO5 Develop AI applications through AI techniques for healthcare

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2	-	-	-	-	-	-	-	-
CO2	2	3	-	2	-	2	2	-	-	-	-	-
CO3	2	-	2	2	-	-	-	-	-	-	-	-
CO4	2	-	-	-	2	2	-	-	-	-	-	-
CO5	-	-	3	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**2**	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE IN HEALTHCARE *(08 Periods)*

Introduction to AI in Healthcare, Benefits & Risks, AI in the health sector, AI versus human intelligence, The future of AI in health sector, AI & Neural networks.

Module 2: THE PRESENT STATE & FUTURE OF AI IN HEALTHCARE SPECIALTIES *(10 Periods)*

Artificial Intelligence in: preventive healthcare, Radiology, Pathology, Surgery, Anesthesiology, Psychiatry, Cardiology, Pharmacy, Dermatology, Dentistry, Orthopedics, Ophthalmology.

Module 3: THE ROLE OF MAJOR CORPORATIONS IN AI IN HEALTHCARE *(08 Periods)*

IBM Watson, The role of Google & Deep mind in AI in Healthcare, Baidu, Facebook & AI in Healthcare, Microsoft & AI in Healthcare.

Module 4: FUTURE OF HEALTHCARE IN AI *(10 Periods)*

Evidence-based medicine, personalized medicine, Connected medicine, Virtual Assistants, Remote Monitoring, Medication Adherence, Accessible Diagnostic Tests, Smart Implantables, Digital Health and Therapeutics, Incentivized Wellness, Block chain, Robots, Robot-Assisted Surgery, Exoskeletons, Inpatient Care, Companions, Drones, Smart Places, Smart Homes, Smart Hospitals.

Module 5: APPLICATIONS OF AI IN HEALTHCARE *(09 Periods)*

Case Study 1: AI for Imaging of Diabetic Foot Concerns and Prioritization of Referral for Improvements in Morbidity and Mortality.

Case Study 2: Outcomes of a Digitally Delivered, Low-Carbohydrate, Type 2 Diabetes Self-Management.

Case Study 3: Delivering A Scalable and Engaging Digital Therapy.

Case Study 4: Improving Learning Outcomes for Junior Doctors through the Novel Use of Augmented and Virtual Reality for Epilepsy.

Case Study 5: Big Data, Big Impact, Big Ethics: Diagnosing Disease Risk from Patient Data.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Analyze how the artificial intelligence is used to predict the disease result and Prognosis Assessment of a patient.
2. How does drug discovery happen and how does AI is helping in drug discovery and Labs.
3. Justify that artificial intelligence provide engineering solutions for early detection and Diagnosis of diseases.
4. Demonstrate the prediction of bladder volume of a patient.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Dr. Parag Mahajan, *Artificial Intelligence in Healthcare*, MedManthra Publications, First Edition 2019.
2. Arjun Panesar, *Machine Learning and AI for Healthcare Big Data for Improved Health*, Apress Publications, 2019.

REFERENCE BOOKS:

1. Michael Matheny, Sonoo Thadaney Israni, Mahnoor Ahmed, and Danielle Whicher, *Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril*, National Academy of Medicine Publication, First Edition 2019.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=-aHBwTQQyNU
2. https://intellipaat.com/blog/artificial-intelligence-in-healthcare/

WEB RESOURCES:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6616181/
2. https://www.ibm.com/topics/artificial-intelligence-healthcare
3. https://builtin.com/artificial-intelligence/artificial-intelligence-healthcare

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CM101701	**BANKING AND INSURANCE**	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Introduction to Banking; Bank-Customer Relationship; Electronic Payment System and Business Models; Introduction to Risk and Insurance; Insurance Overview.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate the importance of Banking and functions of the Reserve Bank of India and its role in the country's sustainable development.

CO2 Demonstrate the role, relationships, and operations between Banker and Customer.

CO3 Demonstrate the Online Banking system, various types of Electronic Payments, and Business models.

CO4 Demonstrate the concept of risk and principles, functions, and, types of Insurance companies.

CO5 Understand the principles of insurance and its functions.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	2	-	-	-	1
CO2	3	-	-	-	-	-	-	2	-	-	-	1
CO3	3	-	-	-	-	-	-	2	-	-	-	1
CO4	3	-	-	-	-	-	-	2	-	-	1	1
CO5	3	-	-	-	-	-	-	2	-	-	1	1
Course Correlation Mapping	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1**	**1**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO BANKING   *(09 Periods)*

Meaning - Importance of banking- Functions of banking - Reserve Bank of India: Functions – Role of RBI in sustainable development.

Module 2:   BANK-CUSTOMER RELATIONSHIP   **(09 Periods)**

Debtor-creditor relationship, deposit products or services, payment, and collection of cheques. Accounts – Types of accounts, the procedure for opening and closing an account - Loans and Advances- principles of lending.

Module 3   ELECTRONIC PAYMENT SYSTEM&BUSINESS MODELS   **(09 Periods)**

Introduction to Online Banking - types of e-payment system, e-cash, NEFT, RTGS, Credit cards, Electronic Wallet and Debit cards. **Business models**- B2B, B2C, C2C, and B2G.

Module 4   INTRODUCTION TO RISK AND INSURANCE   **(09 Periods)**

Insurance: Definition, Insurance as risk mitigation mechanism, elements of insurance. Concept of risk, risk *Vs* uncertainty.

Module 5   INSURANCE OVERVIEW   *(09 Periods)*

Principles of insurance - insurance types - LIC & GIC – insurance functions, IRDA - Insurance Players in India.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Make a PowerPoint presentation on the banking system in India.
2. Submit a report on the working of insurance companies.
3. Prepare a report on the functions of RBI & IRDA in India.
4. Submit a report on electronic banking facilities provided by Indian banks.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1.   RanganadhaChary, A.V. and Paul, R.R., *Banking and Financial system*, Kalyani Publisher, New Delhi, 3rdedition, 2016.
2.   Sharma, R.K., Shashi K. Gupta and Jagwant Singh, *Banking and Insurance*, Kalyani Publishers, New Delhi, 17th edition, 2014

REFERENCES BOOKS:

1.   *Indian Institute of Banking & Finance, Digital Banking*, Taxman Publications Pvt. Ltd., 2016 edition, 2016.

2. Jyotsna Sethi and Nishwan Bhatia, *Elements of Banking and Insurance*, PHI Learning Pvt. Ltd., 2nd edition, 2012.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=a1_p8zhbAfE
2. https://www.youtube.com/watch?v=bxNw9VB5Y_0

WEB RESOURCES:

1. https://unacademy.com/content/railway-exam/study material/economics/importance-of-banking-sector-in-the-country/
2. https://www.geeksforgeeks.org/ life-insurance-meaning-elements-and-types-of-life-insurance-policies/

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22DS101701	**BIOINFORMATICS**	3	-	-	-	3

Pre-Requisite –
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course focus on Biological Data Acquisition, Databases, Data Processing, Methods of Analysis, Applications of Bio-informatics.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1 Understand basic biological data acquisition in bioinformatics.
CO2 Identify the proper databases for the information search by choosing the biological databases and also submission and retrieval of data from databases.
CO3 Analyze the results of bioinformatics data using text and sequence-based searching techniques.
CO4 Analyze the secondary and tertiary structures of proteins by applying different alignment programs
CO5 Design biological databases by using contextual knowledge on bioinformatics.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	3	3	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	3	3	3	-	-	-	-	-	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: BIOLOGICAL DATA ACQUISITION *(09 Periods)*

Biological information, Retrieval methods for DNA sequence, protein sequence and protein structure information

Module 2: DATABASES *(09 Periods)*

Format and Annotation: Conventions for database indexing and specification of search terms, Common sequence file formats. Annotated sequence databases - primary and secondary sequence databases, protein sequence and structure databases.

Module 3: DATA PROCESSING *(09 Periods)*

Data – Access, Retrieval and Submission: Standard search engines; Data retrieval tools – Entrez, DBGET and SRS; Submission of (new and revised) data; Sequence Similarity Searches: Local and global. Distance metrics. Similarity and homology. Scoring matrices, PAM and

BLOSUM

Module 4:   METHODS OF ANALYSIS   *(09 Periods)*

Dynamic programming algorithms, Needleman-Wunsch and Smith-waterman.Heuristic Methods of sequence alignment, FASTA and BLAST; Multiple Sequence Alignment and software tools for pair wise and multiple sequence alignment, CLUSTAL program, Prediction of Tertiary structure of proteins.

Module 5:   APPLICATIONS   *(09 Periods)*

Genome Annotation and Gene Prediction; ORF finding; Phylogenetic Analysis, Genomics, Proteomics, Genome analysis – Genome annotation, DNA Microarray, computer aided drug design (CADD).

Total Periods: 45

EXPERIENTIAL LEARNING

1. Calculate the dynamic programming matrix and one or more optimal alignment(s) for the sequences GAATTC and GATTA, scoring +2 for a match, −1 for a mismatch and with a linear gap penalty of d = 2.
2. Determine whether the RNA string GGACCACCAGG should be folded into two substructures.
3. Discuss how to carry out the multiple sequence alignment of the following three sequences: TTTTAAAA, AAAACCCC, CCCCTTTT.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:
1.   Lesk, A. K., *Introduction to Bioinformatics*, Oxford University Press, 4th Edition, 2013
2.   Dan Gusfield, *Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology*, Cambridge University Press, 1997.

REFERENCE BOOKS:
1.   Baldi, P. and Brunak, S., *Bioinformatics: The Machine Learning Approach*, MIT Press, 2nd Edition, 2001.
2.   Mount, D.W., *Bioinformatics Sequence and Genome Analysis*, Cold Spring Harbor Laboratory Press, 2nd Edition, 2004.
3.   Tindall, J., *Beginning Perl for Bioinformatics: An introduction to Perl for Biologists*, O'Reilly Media, 1st Edition, 2001.

VIDEO LECTURES:
1.   https://www.youtube.com/watch?v=liNblw4x50E
2.   https://www.youtube.com/watch?v=eZfyWdHnzR0

WEB RESOURCES:
1.   https://www.britannica.com/science/bioinformatics
2.   https://www.ebi.ac.uk/training/online/courses/bioinformatics-terrified/what-bioinformatics/

Course Code	Course Title	L	T	P	S	C
22BS101701	**BIOLOGY FOR ENGINEERS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Introduction to living organisms, Proteins, Nucleic acids and enzymes, Genetics and Molecular biology, Recombinant DNA technology, Human physiology and applied biology.

COURSE OUTCOMES: After successful completion of the course, students will be able to

CO1 Identify difference between cells, Cellular components and their functions.

CO2 Understand Proteins, Nucleic acids structure and function and also Mechanism of enzyme action.

CO3 Identify Central dogma of Molecular biology and processes of Molecular Biology.

CO4 Understand Recombinant DNA technology and its importance in creating new Animals and Plants.

CO5 Understand basics and Mechanism of different Physiological process including nerve function and applications of biological sciences.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	-	-	-	-	-	-	-	-	-	-

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1: LIVING ORGANISMS   *(09 Periods)*

Comparison of biological organisms with manmade systems, Classification of living organisms, Cellular basis of life, differences between prokaryotes and eukaryotes, classification on the basis of carbon and energy sources, molecular taxonomy

Module 2: PROTEINS, NUCLEIC ACIDS AND ENZYMES   *(10 periods)*

Biomolecules, structure, function and Classification of proteins, structure, function and Classification of and Nucleic acids, Enzymes, Enzyme nomenclature, Classification of Enzymes and Mechanism of Enzyme action, Industrial applications of enzymes, Fermentation and its industrial applications

Module 3   GENETICS AND MOLECULAR BIOLOGY   *(11 Periods)*

Mendel's laws, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation.

Module 4   RECOMBINANT DNA TECHNOLOGY   *(08 Periods)*

Recombinant DNA Technology: recombinant vaccines, transgenic microbes, plants and animals, animal cloning, biosensors, biochips.

Module 5   HUMAN PHYSIOLOGY AND APPLIED BIOLOGY *(07 Periods)*
Fundamentals of Human physiology, neurons, synaptic and neuromuscular junctions, Introduction to EEG, DNA fingerprinting, DNA Micro array and Genomics.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Identify the Cell and Cellular organelle spotters and write the functions of spotters identified
2. Prepare a table of Enzymes and their importance.
3. Assignments on Central dogma of Molecular biology
4. Identify different organs in the organ system diagrams.
5. Assignments on photosynthesis.
6. Quiz related to organ system and functions.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Rajiv Singal, Gaurav Agarwal, *Biology for Engineers*, CBS, 2019.
2. S. Sing and T. Allen, *Biology for Engineers*, Vayu Education of India, 2014.

REFERENCE BOOKS:

1. B. Alberts, A. Johnson et al., *The molecular biology of the cell*, Garland Science, 6th edition, 2014.
2. A. T. Johnson, *Biology for Engineers*, CRC press, 2011.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=N0Y386SVGN8
2. https://www.youtube.com/watch?v=1Pzk-UqilW4
3. https://www.youtube.com/watch?v=208pMhKoQeo

WEB RESOURCES:

1. Structure and function of Proteins: https://nptel.ac.in/courses/104102016/16
2. Enzyme catalysis: https://nptel.ac.in/courses/103103026/module3/lec35/4.html
3. Biochips: https://nptel.ac.in/courses/112104029/3

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22LG101701	**BUSINESS COMMUNICATION AND CAREER SKILLS**	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: Nature and Scope of Communication, Corporate Communication, Writing Business Messages & Documents, Careers & Résumés, and Interviews.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge of professional communication by analyzing and applying the styles and strategies of business communication in Communication Networks, Interpersonal, and Informal communication.

CO2. Analyze the limitations of communication by applying and demonstrating corporate and cross-cultural communication strategies effectively in a business context and Crisis Management situations.

CO3. Apply appropriate strategies and techniques in writing business messages, business letters, and résumé for effective professional communication and career building.

CO4. Demonstrate appropriate communication techniques and answering strategies by analyzing the expectations during presentations and interviews.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	2	-	-	-	-	3	-	-
CO2	1	2	-	-	2	-	-	-	-	3	1	-
CO3	1	-	-	-	2	-	-	-	-	3	-	-
CO4	1	2	-	-	2	-	-	-	-	3	-	-
Course Correlation Mapping	2	2	-	-	2	-	-	-	-	3	1	-

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT

Module 1:   NATURE AND SCOPE OF COMMUNICATION   *(9 Periods)*

Introduction – Communication Basics – Functions of Communication – Communication Networks – Interpersonal Communication – Informal Communication – Communication Barriers – Roles of a Manager.

Module 2:   CORPORATE COMMUNICATION   *(9 Periods)*

Introduction – Corporate Communication – Cross-Cultural Communication; Concept & Styles – Corporate Communication Strategy – Corporate Citizenship – Crisis Communication: Case Study.

Module 3:   WRITING BUSINESS MESSAGES & DOCUMENTS   *(9 Periods)*

Introduction – Importance of Written Business Communication – Types of Business Messages – Five Main Stages of Writing Business Messages – Business Letter Writing – Kinds of Business Letters – Common Components of Business Letters – Strategies for Writing the Body of a Letter.

Module 4:   CAREERS AND RÉSUMÉS   *(9 Periods)*

Introduction – Career Building – Résumé Formats: Traditional, Electronic and Video Résumé – Sending Résumés – Follow-up Letters – Business Presentations and Speeches: Planning – Structuring – Organizing – Delivery.

Module 5:   INTERVIEWS   *(9 Periods)*

Introduction – General Preparation for an Interview – Success in an Interview – Important Non-verbal Aspects – Types of Interviews – Styles of Interviewing – Types of Interviewing –Online Recruitment Process.

Total Periods: 45

EXPERIENTIAL LEARNING

1. People often get confused in identifying or using English vocabulary on most occasions. Prepare a list of confusing words and find methods to overcome the difficulties in using those words to uplift the career of professionals.

2. Organizations and institutions use modern technology in communicating with their colleagues, clients, and stakeholders. Make a PowerPoint presentation on the modern communication system of any organization and its role in the success of the organization and its career.

3. As a student in the modern technological world, organizing or attending webinars is inevitable. Analyze the pros and cons of video conferencing by organizing webinars and preparing a report.

4. Form a team and act as a team leader. Prepare a performance appraisal report of the team using visual aids to support the presentation.

5. Make a detailed study on social networking and its impact on modern business and Career.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Meenakshi Raman, Prakash Singh, *Business Communication*, Oxford University Press, New Delhi, 2nd edition, 2012.
2. Neera Jain, Sharma Mukherji, *Effective Business Communication*, Tata Mc Graw–Hill

REFERENCE BOOKS:

1. Courtland L. Bovee et al., *Business Communication Today*, Pearson, New Delhi, 2011.
2. Krizan, *Effective Business Communication*, Cengage Learning, New Delhi, 2010.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/110105052
2. https://edurev.in/courses/14522_Business-Communication-The-Ultimate-Guide

WEB RESOURCES:

1. http://www.career.vt.edu/interviewing/TelephoneInterviews.html
2. http://job-search-search.com/interviewing/behavioral_interviews
3. https://goo.gl/laEHOY (dealing with complaints)
4. http://www.adm.uwaterloo.ca/infocecs/CRC/manual/resumes.html
5. https://goo.gl/FEMGXS
6. http://www.resumania.com/arcindex.html

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CE101701	**CIVIL ENGINEERING AND THE SOCIETY**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on introduction to civil engineering, aesthetics of historic and modern civil engineering structures, unpredictable nature and the civil engineering; civil engineering solutions for the problems of traffic, pollution, water and waste management; building sustainable smart cities.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze principles of civil engineering to basic civil engineering problems following ethics and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO2. Analyze aesthetics of historic and modern civil engineering structures to solve complex civil engineering problems using tools and techniques by following ethics and latest trends considering society, environment and sustainability besides communicating effectively in graphical form.

CO3. Analyze unpredictable nature and the role of civil engineering to solve complex civil engineering problems using tools and techniques by following ethics and considering society, environment and sustainability besides communicating effectively in graphical form.

CO4. Analyze civil engineering solutions for the problems of traffic, pollution, water and waste management to solve complex problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

CO5. Analyze the building principles of sustainable smart cities to solve complex problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	2	3	2	-	1	-	1
CO2	3	3	-	1	2	2	2	2	-	1	-	1
CO3	3	3	-	1	2	2	2	2	-	1	-	-
CO4	3	3	-	1	2	2	2	2	-	1	2	-
CO5	3	3	-	1	2	2	2	2	-	1	2	-
Course Correlation Mapping	**3**	**3**	**-**	**1**	**2**	**2**	**2**	**2**	**-**	**1**	**2**	**1**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO CIVIL ENGINEERING   *(07 Periods)*

Philosophy of civil engineering, Disciplines of civil engineering, Evolution of construction and civil engineering in the world; Civil engineer - Duties and responsibilities, Role of Civil engineer in the society; Civil engineering materials and their applications, Latest advancements in civil engineering.

Module 2:   AESTHETICS OF HISTORIC AND MODERN CIVIL   *(09 Periods)*
**   ENGINEERING STRUCTURES**

Aesthetics in civil engineering structures; Aesthetic principles and techniques - Analysis of materials, textures and colors in aesthetic design, Integration of aesthetics with structural engineering principles; Historic civil engineering structures - Case studies of iconic historic structures (e.g. Colosseum, Taj Mahal, Eiffel Tower); Modern civil engineering structures - Exploration of contemporary iconic structures (e.g. Burj Khalifa, Sydney Opera House, Golden Gate Bridge); Integration of aesthetics and functionality - Ethical considerations in balancing aesthetics, functionality and sustainability; Future trends in aesthetic engineering.

Module 3   UNPREDICTABLE NATURE AND THE CIVIL ENGINEERING   *(09 Periods)*

Unpredictable nature, Examples of unpredictable natural disasters - Earthquakes, Floods, Landslides, Hurricanes, Tsunamis, Impacts of unpredictable natural events on infrastructure; Role of civil engineering; Resilience in civil engineering - Strategies for building resilient structures, Risk assessment and analysis, Incorporating safety factors, Using robust construction materials, Implementing redundancy and backup systems, Sustainable design practices; Case studies of successful resilient designs.

Module 4   CIVIL ENGINEERING SOLUTIONS FOR THE PROBLEMS OF   *(11 Periods)*
**   TRAFFIC, POLLUTION, WATER AND WASTE MANAGEMENT**

Introduction to urban challenges and sustainable development; Traffic management solutions - Causes and impacts of traffic congestion, Intelligent transportation systems; Pollution control and environmental engineering, Sources and types of urban pollution, Air quality monitoring and control strategies, Water pollution control, Noise pollution management, Sustainable construction practices to reduce pollution; Water resource management, Water demand and supply management in urban areas, Rainwater harvesting techniques, Water conservation and wastewater treatment technologies; Waste management strategies, Solid waste generation and disposal challenges, Waste-to-energy conversion technologies, Case studies of successful waste management initiatives; Integration and synergies among Solutions, Multi-disciplinary approach for holistic solutions.

Module 5   BUILDING SUSTAINABLE SMART CITIES   *(09 Periods)*

Smart city; Elements of smart city infrastructure – Buildings, Mobility, Energy, Water, Waste management, Health and digital layers; Need for an integrated approach; Role of science, technology and innovation in the implementation of smart infrastructure; Smart infrastructure design principles and policies; Case studies: Gujarat International Finance Tech-City in India.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Group discussion on compatibility of modern construction materials compared to that of traditional civil engineering materials
2. Poster presentation on historic and modern civil engineering structures.
3. Submit a case study report on Life Cycle Analysis (LCA) of any one of the historic civil engineering structure.
4. Submit a case study report on the theme of severity of the natural disasters on the Civil engineering structures.
5. Debate on challenges, limitations and solutions for design and implementation of smart city.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. David Muir Wood., *Civil Engineering: A Very Short Introduction*, Oxford University Press, 1st Edition, 2012.
2. Roger Scruton, *The Aesthetics of Architecture*, Princeton University Press, 2nd Edition, 2013.

REFERENCE BOOKS:

1. Anubha Kaushik and C. P. Kaushik, *Perspectives in Environmental Studies*, New Age International (P) Ltd Publications, 6th Edition, 2018.
2. Sang Lee (Editor), *Aesthetics of Sustainable Architecture*, 010 publishers, 1st Edition, 2013.
3. Marc Kushner, *The Future of Architecture in 100 Buildings*, Simon and Schuster, 1st Edition, 2015.
4. Nicholas J. Garber and Lester A. Hoel, *Traffic and Highway Engineering*, Nelson Engineering, 1st Edition, 2008.
5. Stephen M. Wheeler and Timothy Beatley, *Sustainable Urban Development*, Reader Routledge Urban Reader Series, 3rd Edition, 2014.
6. Larry W. Mays, *Water Resources Engineering*, Wiley India Private Limited, 3rd Edition, 2011.
7. Hans Straub, *A History of Civil Engineering: An Outline from Ancient to Modern Times*, The MIT Press, 4th Edition, 1964.
8. Brian Vanden Brink, *Iconic: Perspectives on the Man-Made World*, Down East Books, Illustrated Edition, 2012.

VIDEO LECTURES:

1. https://archive.nptel.ac.in/courses/123/105/123105001/
2. https://onlinecourses.nptel.ac.in/noc22_ce42/preview
3. https://onlinecourses.nptel.ac.in/noc19_ce31/preview
4. https://onlinecourses.nptel.ac.in/noc20_ce07/preview

WEB RESOURCES:

1. https://bregroup.com/insights/aesthetics-in-architecture-how-beauty-and-design-are-inspiring-each-other/
2. https://keckwood.com/news-updates/how-civil-engineers-help-during-disaster-recovery/#:~:text=Civil%20engineers%20provide%20humanitarian%20and,shortages%20to%20hard%2Dhit%20communities
3. https://smartcities.gov.in/
4. https://www.twi-global.com/technical-knowledge/faqs/what-is-civil-engineering
5. https://www.ice.org.uk/engineering-resources/knowledge-resources/water-and-waste-water-management

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22SS101701	**CONSTITUTION OF INDIA**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides and in-depth knowledge about Constitution of India's Preamble and its Philosophy; Union Legislature; Federalism in India; Judiciary and Public Services; Nation Building. The students can gain first-hand information and knowledge about these dynamics and accordingly act based on these sources in their professional and routine activities.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1: Demonstrate knowledge in the Parliamentary proceedings, Election Commission, Public Services and Foreign Policy of India.

CO2: Apply the reasoning informed by the various aspects of the Constitution and its provisions to assess societal issues and the consequent responsibilities relevant to the professional engineering practice.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	-	-	-	-	3	2	-	-	-	-	-
CO2	2	-	-	-	-	3	-	3	-	-	-	-
Course Correlation Mapping	**2**	**-**	**-**	**-**	**-**	**3**	**2**	**3**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   PREAMBLE AND ITS PHILOSOPHY   *(9 Periods)*

Introduction to Indian Constitution; Evolution of Indian Constitution; preamble and its philosophy

Module 2:   UNION LEGISLATURE   *(9 Periods)*

The Parliament, Parliamentary Structure, Process of Legislation; President of India – Powers and Functions; Prime Minister and Council of Ministers; Constitution Amendment Procedure.

Module 3:   FEDERALISM IN INDIA   *(9 Periods)*

Centre-State Administrative Relationship; Governors – Powers and Functions; State Legislature - Composition and powers; Chief Ministers - Powers and Functions; The Election Commission – Powers and Functions.

Module 4:   JUDICIARY AND PUBLIC SERVICES   *(9 Periods)*

The Union Judiciary - Supreme Court and High Court; Fundamental Rights and Duties All India Services - Central Civil Services -State Services - Local Services.

Module 5: INTERNATIONAL PARTICIPATION *(9 Periods)*

Foreign Policy of India; International Institutions Influence: UNO, WTO, WHO, SAARC, International Summits: BRICS, NSS, UNEP – India's Role in International Negotiations; Environmentalism in India.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Review newspapers and submit a report on critical analysis of Indian Civil Servants exercise of powers, in the awake of constitutionally assigned authority.
2. Visit your village Panchayat office or Municipality office and generate a report on your observations about maintained Constitutional symbolism.
3. Watch few videos on recent Indian Independence Day and Republic Day celebrations as marked in New Delhi and present a detailed report, by considering the following aspects:
    a) Comparatively analyze the speeches of the President of India and Prime Minister of India as delivered on these two occasions.
    b) Compare these two events relevance in terms of Indian Armed Forces presence.
    c) Observe, compare and analyse 'flag code' relevance as marked in these two events.
4. Watch a few videos on recent 'proceedings' of any state Legislative Assembly session and submit a detailed report.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:
1. Briji Kishore Sharma, *Introduction to the Constitution of India*, Prentice Hall of India, 2005

REFERENCE BOOKS:
1. Mahendra Pal Singh,V. N. Shukla's, *Constitution of India*, Eastern Book Company, 2011.
2. Pandey J. N., *Constitutional Law of India*, Central Law Agency, 1998

VIDEO LECTURES:
1. Doctrine of Basic Structure: https://www.youtube.com/watch?v=cvUf9ZeEe8Y
2. Significance of the Constitution: https://www.youtube.com/watch?v=vr1Dc_-ZKbQ

WEB RESOURCES:
1. The Constitution of India: https://www.youtube.com/watch?v=of2SoO8i8mM
2. Protection of Constitutional Democracy: https://www.youtube.com/watch?v=smJ99cdPrns

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CM101702	**COST ACCOUNTING AND FINANCIAL MANAGEMENT**	3	-	-	-	3

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: Cost accounting; cost sheet & preparation of cost sheet; standard costing & variance analysis; financial management & ratio analysis; introduction to investment**.**

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1   Demonstrate the concepts of Cost Accounting and Management Accounting and the elements of costing.

CO2   Determine the Cost of Production for pricing decisions.

CO3   Apply the Standard Costing and Variance techniques for the control of the cost of production

CO4   Analyze the Profitability and financial condition of an organization using Ratios.

CO5   Apply Capital Budgeting techniques for making investment decisions in an organization.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	2	-	-	1	-	-	-	-
CO2	3	-	-	-	2	-	-	1	-	-	1	-
CO3	3	-	-	-	2	-	-	1	-	-	1	-
CO4	3	-	-	-	2	-	-	1	-	-	1	-
CO5	3	-	-	-	2	-	-	1	-	-	-	-
Course Correlation Mapping	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**-**	**1**	**-**

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT

Module 1:   COST ACCOUNTING   *(09 Periods)*

Meaning of Cost and Cost Accounting, Objectives, Scope, Advantages, and Disadvantages – Cost Accounting *Vs* Management Accounting – Elements of Costing – Installation of costing system – Material Control, Labor Control, Overhead Control.

Module 2:   COST SHEET & PREPARATION OF COST SHEET   **(09 Periods)**

Analysis of Cost – Preparation of cost sheet, estimate, tender, and quotation (Simple problems) – Importance of Costing while pricing the products

Module 3   STANDARD COSTING & VARIANCE ANALYSIS   **(09 Periods)**

Introduction to Standard Costing & Variances – Variance Analysis: Material variances, Labor variances (Simple Problems).

Module 4   FINANCIAL MANAGEMENT & RATIO ANALYSIS   **(09 Periods)**

Meaning, Objectives - Nature and Scope, Importance of FM – Ratio Analysis**:** Types of Ratios: Solvency Ratios, Liquidity Ratios, Turnover Ratios, and Profitability Ratios - Financial Statement Analysis through Ratios (Simple Problems).

Module 5   INTRODUCTION TO INVESTMENT   *(09 Periods)*

Investment - Meaning and Definition- concept of risk and returns - Capital budgeting techniques – Security Analysis and Portfolio Management (Basic concepts).

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare a report on the role of cost accountants in the growth of a company.
2. To visit the manufacturing unit to observe how they used various techniques for analyzing the financial health of a company.
3. Prepare a report on factors influencing the form of business organization.
4. Prepare the cost sheet with practical examples of any two manufacturing companies.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1.   S.P. Jain and K.L. Narang: *Cost Accounting*, Kalyani Publishers, Ludhiana, 10th edition, 2016.
2.   I.M. Pandey, *Financial Management*, Vikas Publishing House Pvt. Ltd., 14th edition, 2016.

REFERENCE BOOKS:

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1. The Institute of Company Secretaries of India, *Cost and Management Study Material*, New Delhi.
2. CA Saravana Prasath, *Cost Accounting and Financial management*, Wolters Kluwer India Pvt. Ltd., New Delhi, 2018.

VIDEO LECTURES:

1 https://www.youtube.com/
watch?v=ESqO8sFgQa0&list=PLLhSIFfDZcUVE2kzOhEubO9rkvUOAgZbz

2 https://www.youtube.com/
watch?v=tzasFmP1CpAhttps://www.youtube.com/watch?v=tzasFmP1CpA

WEB RESOURCES:

1 https://www.tutorialspoint.com/
accounting_basics/management_versus_cost_accounting.htm

2 https://www.netsuite.com
/portal/resource/articles/financial-management/financial-management.shtml

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UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101701	**CYBER LAWS AND SECURITY**	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Cyber Crimes and Indian IT Act; Cyber Offenses; Tools and Methods used in Cyber Crime; Phishing ad Identity Theft; Indian and Global Perspective on Cyber Crimes and Cyber Security; Organizational Implications on Cyber Security; IPR Issues; Cyber Crime and Terrorism; Cyber Crime Illustrations

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Demonstrate knowledge in Cyber security, Cybercrimes and its related laws in Indian and Global Act.
CO2. Analyze the legal perspectives and laws related to cybercrimes in Indian context.
CO3. Apply security and privacy methods in development of modern applications and in organizations to protect people and to prevent cybercrimes.
CO4. Solve Cyber security issues using privacy policies and Use antivirus tools to minimize the impact of cyber threats.
CO5. Apply security standards for the implementation of Cyber Security and laws.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO CYBER CRIMES AND OFFENSES   *(09 Periods)*
Cyber Crimes: Introduction, Definition, Origin, Cybercrime and information security, Cyber criminals, Classifications of cybercrimes, The legal perspectives and Indian perspective, Cybercrime and Indian ITA 2000, Global perspective on cybercrimes.
Cyber Offenses: Introduction, Criminals planning on attacks, Social engineering, Cyber stalking, Cyber cafe and crimes, Botnets.

Module 2:   TOOLS AND METHODS USED IN CYBER CRIME AND   *(09 Periods)*
**   PHISHING AND IDENTITY THEFT**

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Introduction, Proxy servers and Anonymizers, Phishing, Password cracking, Key loggers and Spywares, Virus, Worms and Ransomware, Trojan horses and Backdoors, Steganography, DoS and DDoS attacks.

Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).

Module 3 CYBER CRIMES AND CYBER SECURITY-LEGAL *(08 Periods)*
PERSPECTIVES

Introduction, Cyber laws in Indian context, The Indian IT act, Challenges to Indian law and Cybercrime scenario in India, Consequences of not addressing the weakness in IT act, Digital signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber law, Technology and Students in India scenario.

Module 4 CYBER SECURITY-ORGANIZATIONAL IMPLICATIONS *(10 Periods)*

Introduction, Web threats for organizations – evils and perils, Security and privacy implications from cloud computing, Social Media Marketing-Security risks and Perils for organizations, Social computing and associated challenges for organizations, Protecting people's privacy in organization, Organizational guidelines for internet usage, Safe computing and Usage policy, Incident handling and Best practices.

Module 5 CYBER CRIME AND TERRORISMAND ILLUSTRATIONS *(09 Periods)*

Cyber Crime & Terrorism: Introduction, Intellectual property in the cyber space, The ethical dimension of cybercrimes, The psychology, Mindset and skills of hackers and cyber criminals, Sociology of cyber criminals, Information warfare.

Cyber Crime Illustrations: Indian banks lose millions of rupees, Justice vs. Justice, Parliament attack, The Indian case of online gambling, Bank and credit card related frauds, Purchasing goods and services scam, Nigerian 419 scam.

Total Periods: 45

EXPERIENTIAL LEARNING

1. The Cyber Security Risks on Social Media – Learn from Case Studies: https://www.rswebsols.com/tutorials/internet/cyber-security-risks-social-media
2. SIX automates key cybersecurity tasks to actively protect itself against social media threats: https://www.hootsuite.com/resources/six-group-case-study
3. Important Cyber Law Case Studies : https://www.cyberralegalservices.com/detail-casestudies.php

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:
1. Nina Gobole, SunitBelapure, *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley India, 2011.

REFERENCE BOOKS:
1. Prashant Mali, *Cyber Law and Cyber Crimes*, Snow White Publications Pvt. Ltd., 2013.
2. Alfred Basta and et al, *Cyber Security and Cyber Laws*, Cengage Learning India 2018

VIDEO LECTURES:
1. Learn Cyber Security | Cyber Security Training:
   https://www.youtube.com/watch?v=PlHnamdwGmw
2. Cyber Security For Beginners: https://www.youtube.com/watch?v=4RE4d23tDFw

WEB RESOURCES:
1. https://study.com/academy/course/computer-science-110-introduction-to-cybersecurity.html
2. https://www.pandasecurity.com/en/mediacenter/panda-security/types-of-cybercrime/
3. https://mediasmarts.ca/digital-media-literacy/digital-issues/cyber-security/cyber-security-spam-scams-frauds-identity-theft

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Course Code	Course Title	L	T	P	S	C
22EE101701	**ELECTRICAL SAFETY AND SAFETY MANAGEMENT**	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION:
The course deals with the various aspects of potential risk due to electrical shock; safety precautions to be followed while working in hazardous zones; safe practices while handling various electrical equipment and during maintenance; and relevant electrical safety standards and Indian rules and acts.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Understand the Indian electricity rules, regulations and various standards to be maintained for the safety of life and equipment.
CO2. Understand the potential effects of electrical shock and safety measures to protect against such risk.
CO3. Understand the safety aspects and safe practices to be followed while installing residential, commercial, and agricultural appliances.
CO4. Identify various hazardous working zones and take necessary precautionary measures while working in such areas.
CO5. Follow safety measures during installation, testing and commissioning, and maintenance of electrical equipment/plant.

CO-PO Mapping Table

Course Outcome	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	1	3	1	3	-	-	-	1
CO2	3	-	-	-	1	2	2	-	-	-	-	1
CO3	3	-	-	-	1	2	2	-	-	-	-	1
CO4	3	-	-	-	2	3	2	2	-	-	-	1
CO5	3	-	-	-	-	3	2	2	-	-	-	1
Course Correlation Mapping	**3**	**-**	**-**	**-**	**1**	**3**	**2**	**3**	**-**	**-**	**-**	**1**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

**Module 1:   INDIAN ELECTRICITY RULES AND ACTS, AND THEIR   *(10 Periods)*
              SIGNIFICANCE**
OSHA standards of electrical safety, Basic electrical safety rules as per OSHA; Objectives and scope of IE acts and IE rules, Ground clearance and Section Clearances, Clearance in transmission and distribution lines, Significance of Equipment Earthing, Earthing of equipment bodies, structures and non-current carrying metallic parts, Earthing of system neutral; Rules regarding first aid and firefighting facility, Electrical safety general requirements as per IE rules.

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Module 2:   INTRODUCTION TO ELECTRICAL SAFETY AND SAFETY *(10 Periods)*
MANAGEMENT

Electric Safety: Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, Protection against electrical hazards and types, Effect of current on the human body, Principles of electrical safety and approach to prevent accidents.

Electric shocks and its prevention: Primary and secondary electrical shocks, possibilities of getting an electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, Safety precautions in LV installations and electric plant.

Module 3:   ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL, *(08 Periods)*
AND AGRICULTURAL INSTALLATIONS

Introduction—Wiring and fitting; Domestic appliances—water tap giving a shock, shock from wet wall, fan firing shock; Multi-storied building, Temporary installations, Agricultural pump installation; Do's and Don'ts for safety in the use of domestic electrical appliances; Principles of safety management in electrical plants, safety auditing, and economic aspects.

Module 4:   ELECTRICAL SAFETY IN HAZARDOUS AREAS   *(07 Periods)*

Hazardous zones—class 0, 1 and 2; Sparks, flashovers and corona discharge in electrical plants; equipment for hazardous locations; scope for live line work, principles of live line maintenance, special tools for live line maintenance, safety instructions for working on HV lines/apparatus.

Module 5:   SAFETY   DURING   INSTALLATION   TESTING   AND *(10 Periods)*
MAINTENANCE

Safety during installations: Preliminary preparations, preconditions for the start of installation work and safe sequence, safety aspects during installations of Transformers and Rotating machines.

Safety during testing: Purpose of commissioning checks and tests, equipment tests, high voltage energization tests, performance and acceptance tests, and safety aspects during commissioning.

Safety during maintenance: Operators' safety, Types of safety maintenance, Safety procedures, safety precautions during maintenance, and planning of maintenance.

Total Periods: *45*

EXPERIENTIAL LEARNING

1. Study and submit a report on various electrical safety standards followed in abroad countries.

2. Visit a nearby industry and submit a report on various safety measures followed in the industry.

3. Study and submit a report on standard practices followed during the maintenance/commissioning of the electrical apparatus in any industry.

4. Collect information about various safety/alert sign boards and the relative measures for a particular situation.

5. Should practice preliminary first aid assistance such as Cardiopulmonary resuscitation (CPR) and shall demonstrate.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

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RESOURCES

TEXT BOOKS:

1. Rao, Prof. H.L. Saluja, *Electrical Safety, Fire Safety Engineering and Safety Management*, Khanna Publishers. New Delhi, 2nd Edition, 2018 Reprint.

REFERENCE BOOKS:

1. Cadick, John, Mary Capelli-Schellpfeffer, and Dennis K. Neitzel, *Electrical safety Handbook,* McGraw-Hill Education, 2012.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=g-ofq7i_u48

WEB RESOURCES:

1. https://cercind.gov.in/Act-with-amendment.pdf
2. https://www.edapp.com/blog/electrical-safety-training-topics/

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UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22MG101701	**ENTREPRENEURSHIP FOR MICRO, SMALL AND MEDIUM ENTERPRISES**	3	-	-	-	3

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: To understand the setting up and management of MSMEs and initiatives of Government and other institutions support for growth and development of MSMEs

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1.   Understand the basic of SME and challenges of MSMEs

CO2.   Explain the opportunities to Set-Up SSI/SME Units and role of rural & women entrepreneurship.

CO3.   Illustrate roles of various institutions supporting MSMEs.

CO4.   Understand Management of MSME, NPA & sickness units

CO5.   Evaluate role of Government in Promoting Entrepreneurship

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	2	1	-	-	-	-	-	-	-	-
CO2	1	1	2	-	-		2		1			-
CO3	2	2	1	-	-	-	-	1	-	-	2	
CO4	3	1	2	-	-	-	-	-	-	-	-	2
CO5	2	2	1	-	-	1	-	-	-	-	-	1
Course Correlation Mapping	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	1	**-**	**2**	**2**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION2   *(07 Periods)*
Concept & Definition, Role of Business in the modern Indian Economy SMEs in India, Employment and export opportunities in MSMEs. Issues and challenges of MSMEs

Module 2:   MSME SETTING   *(09 Periods)*
Identifying the Business opportunity, Business opportunities in various sectors, formalities for setting up an enterprise - Location of Enterprise – steps in setting up an enterprise – Environmental aspects in setting up, Incentives and subsidies.

Module 3:   MSMES SUPPORTING INSTITUTIONS   *(09 Periods)*

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Forms of Financial support, Long term and Short term financial support, Sources of Financial support, Development Financial Institutions, Investment Institutions, Central level institutions, State level institutions, Other agencies, Commercial Bank – Appraisal of Bank for loans

Module 4:   MANAGEMENT OF MSME   *(10 Periods)*
Management of Product Line; Communication with clients – Credit Monitoring System - Management of NPAs - Restructuring, Revival and Rehabilitation of MSME, Problems of entrepreneurs – sickness in SMI – Reasons and remedies –– Evaluating entrepreneurial performance

Module 5:   ENTREPRENEURSHIP PROMOTION   *(10 Periods)*
MSME policy in India, Agencies for Policy Formulation and Implementation: District Industries Centers (DIC), Small Industries Service Institute (SISI), Entrepreneurship Development Institute of India (EDII), National Institute of Entrepreneurship & Small Business Development (NIESBUD), National Entrepreneurship Development Board (NEDB)

Total Periods: 45

EXPERIENTIAL LEARNING

1. Present a case study on MSMEs Business Strategies.

2. Collect the data about nearby MSMEs and Present their structures in a PPT

3. Discuss in the group MSMEs opportunities in terms of Orientation and Develop mentation.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Vasant Desai, *Small Scale Industries and Entrepreneurship*, Himalaya Publishing House, 2003..
2. Poornima M Charanthimath, *Entrepreneurship Development Small Business Enterprises*, Pearson, 2006.

REFERENCE BOOKS:

1. Suman Kalyan Chaudhury, *Micro Small and Medium Enterprises in India Hardcover*, Raj Publications, 2013.
2. Aneet Monika Agarwal, *Small and medium enterprises in transitional economies, challenges and opportunities*, DEEP and DEEP Publications
3. Paul Burns & Jim Dew Hunt, *Small Business Entrepreneurship*, Palgrave Macmillan publishers, 2010.

VIDEO LECTURES:

1. https://sdgs.un.org/topics/capacity-development/msmes

2. https://blog.tatanexarc.com/msme/msme-schemes-in-india-for-new-entrepreneurs-and-start-ups/

WEB RESOURCES:

1. ncert.nic.in/textbook/pdf/kebs109.pdf

2. https://www.jetir.org/papers/JETIR1805251.pdf

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UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CE101702	**ENVIRONMENTAL POLLUTION AND CONTROL**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on fundamentals of air pollution, dispersion of pollutants, effects and control of air pollution, water pollution, soil pollution and control, and municipal solid waste management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Analyze air and noise pollution using appropriate tools and techniques to solve complex environmental issues following relevant standards considering society, environment and sustainability besides communicating effectively in graphical form.

CO2 Analyze air and noise pollution control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO3 Analyze water pollution and its control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO4 Analyze soil pollution and its control measures using appropriate tools and techniques to solve complex environmental issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO5 Analyze solid waste and its management measures using appropriate tools and techniques to solve solid waste disposal issues following relevant standards and latest developments considering society, environment and sustainability besides communicating effectively in graphical form.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	-	2	2	3	3	2	-	1	-	-
CO2	2	3	-	2	2	3	3	2	-	1	-	1
CO3	2	3	-	2	2	3	3	2	-	1	-	1
CO4	2	3	-	2	2	3	3	2	-	1	-	1
CO5	2	3	-	2	2	3	3	2	-	1	1	1
Course Correlation Mapping	**2**	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**-**	**1**	**1**	**1**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1: AIR AND NOISE POLLUTION   *(08 Periods)*

Air Pollution: Scope, Significance, Classification, Sources – Line, Area, Stationary, Mobile; Effects of air pollutants on man, material and vegetation; Global effects of air pollution; Air pollution meteorology - Lapse rate, Inversion, Plume pattern; Dispersion of air pollutants - Dispersion models and applications; Ambient air quality standards.
Noise Pollution: Sound pressure, Power and intensity, Impacts of noise, permissible limits of noise pollution, measurement of noise, Noise standards.

Module 2: AIR AND NOISE POLLUTION CONTROL   *(10 Periods)*

Self-cleansing properties of the environment, Dilution method, Control at source, Process changes and equipment modifications, Control of particulates – Types of equipment, Design and operation - Settling chambers, Centrifugal separators, Bag house filters, Wet scrubbers, Electrostatic precipitators; Control of gaseous pollutants – Adsorption, Absorption, Condensation, Combustion; Control of air pollution from automobiles, Control of noise pollution, Case studies, Latest developments in the air and noise pollution control.

Module 3: WATER POLLUTION AND CONTROL   *(10 Periods)*

Water pollution – Sources, Causes, Effects; Surface and groundwater quality – Physical, Chemical, Biological; Drinking water quality standards, Water purification – Processes, Engineered systems – Aeration, Solids separation, Settling operations, Coagulation, Softening, Filtration, Disinfection; Wastewater – Sources, Causes, Effects, Treatment process and disposal – Primary, Secondary, Tertiary; Case studies, Latest developments in the water pollution control.

Module 4: SOIL POLLUTION AND CONTROL   *(08 Periods)*

Soil pollutants, Sources of soil pollution, Causes, Effects and control of soil pollution, Diseases caused by soil pollution, Methods to minimize soil pollution, Effective measures to control soil pollution, Soil quality standards, Case studies, Latest developments in the soil pollution control.

Module 5: MUNICIPAL SOLID WASTE MANAGEMENT   *(09 Periods)*

Municipal solid waste – Types, Composition and characteristics; Methods of collection and transportation; Methods of disposal – Open dumping, Sanitary landfill, Composting and Incineration; Utilization - 6R Concept, Recovery and recycling and Energy Recovery; Latest developments in solid waste management.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Explain plume patterns due to air pollution and meteorology effects and draw a neat sketch of plume pattern from any chimney that you have observed in recent times.

2. Compare the different air pollution control equipment used in India and draw a neat sketch line diagram of equipment you have seen in any of your industrial visit.

3. Submit a study report on Coagulation, Flocculation, Sedimentation, Filtration and Disinfection in your own words after watching a YouTube video on water treatment.

4. Enumerate the effective measures to control soil pollution with any two case studies.

5. Submit a report on case studies on the use of 6Rs concept of Municipal Solid Waste Management.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Peavy, H. S, Rowe, D. R., and Tchobanoglous, G., *Environmental Engineering*, McGraw Hill Inc., 1985.
2. C. S. Rao, *Environmental Pollution Control Engineering*, New Age International Pvt. Ltd., 2nd Edition, 2007.
3. Ibrahim A. Mirsa, *Soil Pollution: Origin, Monitoring & Remediation*, Springer, UK, 2nd Edition, 2008.

REFERENCE BOOKS:

1. M. N. Rao and H. V. N. Rao, *Air Pollution,* Tata McGraw–Hill Education Pvt. Ltd., 19th Edition, 2010.
2. Daniel Vallero, *Fundamentals of Air Pollution,* Academic Press (Elsevier)*,* 5th Edition, 2014.
3. S. M. Khopkar, *Environmental Pollution Monitoring and Control,* New Age International Pvt. Ltd., 2nd Edition, 2007.
4. V. M. Domkundwar, *Environmental Engineering*, DhanpatRai & Co. Pvt. Ltd., New Delhi, 2014.

VIDEO LECTURES:

1. https://archive.nptel.ac.in/courses/123/105/123105001/

2. https://archive.nptel.ac.in/courses/105/107/105107213/

3. https://archive.nptel.ac.in/courses/103/107/103107084/

WEB RESOURCES:

1. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202005012116016435Ranvijay-Pratap-Singh-Environmental-Pollution.pdf

2. https://www.deshbandhucollege.ac.in/pdf/resources/1585622878_HIST_(HONS.)_II_Env-Pollution.pdf

3. https://www.jica.go.jp/jica-ri/IFIC_and_JBICI-Studies/english/publications/reports/study/topical/health/pdf/health_08.pdf

4. https://www.iitr.ac.in/wfw/web_ua_water_for_welfare/education/proceeding_of_short-term_training/diploma/Environmental_Sciences_May_24-28_2007/Lecture_notes/Env_Pollution-rb.pdf

5. https://anits.edu.in/online_tutorials/es/Unit%203.pdf

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22EC101702	**ESSENTIALS OF VLSI**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course contains the topics that make student realize the need for Testing. The various types of testing along with Fault Modeling. Test methods for evaluation and test generation algorithms, Delay Tests, IDDQ Tests for testing the circuits , Ad-Hoc DFT Methods, Scan Based Designs, Built-In Self Test.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the importance of Testing, fault models and related theorems.

CO2. Analyze various test methods as applicable to digital circuits.

CO3. Appraise the various combinational and sequential circuit test generation algorithms for functional verification of digital circuits

CO4. Assess delay test algorithms and IDDQ test algorithms for at-speed testing of CMOS Integrated Circuits.

CO5. Recognize the concepts and architectures for Built-In Self Test to satisfy industry specifications.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	-
CO3	3	3	2	2	2	-	-	-	-	-	-	-
CO4	3	3	2	2	2	-	2	3	-	-	-	-
CO5	3	-	-	-	-	-	-	3	-	-	-	-
Course Correlation Mapping	**3**	**3**	**2**	**2**	**2**	**-**	**2**	**3**	**-**	**-**	**-**	**-**

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT

Module 1: INTRODUCTION TO VLSI   *(09 Periods)*

Levels of Abstraction, VLSI Design Flow, MOS Transistor - Characteristics, $I_{DS} - V_{DS}$ Relation, NMOS and CMOS Logic – Logic Gates Design, NMOS and CMOS Fabrication Process.

Module 2: CMOS CIRCUIT DESIGN PROCESS   *(10 Periods)*

MOS Layers, Stick Diagrams, NMOS and CMOS Design Styles, Lambda based Design Rules, NMOS and CMOS Layouts for Inverter and Universal Gates, Sheet Resistance, Capacitance and Delay Calculations, Effects of Scaling.

Module 3: SUBSYSTEM DESIGN   *(11 Periods)*

Adders – Manchester Carry Chain Adder, Carry Look Ahead Adder, Carry Select Adder, Carry Skip adder, Barrel Shifter, Multiplier – Array Multiplier, Booth Multiplier.

Module 4: PROGRAMMABLE HARDWARE   *(06 Periods)*

Design Styles, Programmable Interconnects, Field Programmable Gate Arrays, Complex Programmable Logic Devices, Cell based Design Methodology.

Module 5: DESIGN FOR TESTABILITY   *(09 Periods)*

Ad-Hoc DFT Methods, Full Scan Design, Partial Scan Design, Random Logic BIST – Test-per-Clock and Test-per-Scan BIST Systems; Boundary Scan Standard – TAP Controller and Port.

Total Periods: 45

EXPERIENTIAL LEARNING
1. Develop and Illustrate D – algorithm for Sequential Circuits.
2. Illustrate the applicability of existing testing algorithms for circuits with multiple stuck-at-faults.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Michael L. Bushnell, Vishwani D. Agrawal, *Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits,* Kluwer Academic Pulishers, Springer US, New York, 2006*.*

REFERENCE BOOKS:

1. Miron Abramovici, Melvin A. Breur, Arthur D.Friedman, *Digital Systems Testing and Testable Design*, Wiley, Jaico Publishing House, 1st Edition, 2001.

2. Alfred L. Crouch, *Design for Test for Digital ICs & Embedded Core Systems*, Pearson Education, 1st Reprint Edition, 2007.

3. Robert J.Feugate, Jr., Steven M.Mclntyre, *Introduction to VLSI Testing*, Prentice Hall, 1st Illustrated Edition, 1998.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/117105137
2. https://nptel.ac.in/courses/117103125
3. https://nptel.ac.in/courses/106103016
4. https://archive.nptel.ac.in/courses/106/103/106103116/

WEB RESOURCES:

1. https://www.electronics-tutorial.net/vlsi-design-for-testability/IC-Testing.html
2. https://alexromanov.github.io/2022/08/14/what-is-testability/

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101702	**INTRODUCTION TO ETHICAL HACKING**	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on ethical hacking overview, role of security and penetration testers, foot printing, reconnaissance and scanning networks, enumeration and vulnerability analysis, system hacking, network protection systems.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Understand and recognize role of security and penetration testers to protect the system from malware attacks.
CO2. Apply the foot printing tools to find the vulnerabilities in the system.
CO3. Analyze vulnerabilities to find the system security loopholes or flaws in networked systems within a given range of IP
CO4. Apply the web attackers tools to assess the website's security
CO5. Identify the possible incidents and threats, alert administrators, and prevent potential attacks using IDS

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-
CO5	3	2	3	2	-	-	-	-	-	-	-	-
Average	3	3	3	2	-	-	-	-	-	-	-	-
Course Correlation mapping	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION *(10 Periods)*
Ethical Hacking Overview, Role of Security and Penetration Testers .Penetration, Testing Methodologies, Laws of the Land, Overview of TCP/IP, The Application Layer, The Transport Layer, The Internet Layer, IP Addressing, Network and Computer Attacks, Malware, Protecting Against Malware Attacks, Intruder Attacks, Addressing Physical Security.

Module 2:   FOOT PRINTING, RECONNAISSANCE AND SCANNING *(09 Periods)*
NETWORKS
Foot printing Concepts, Foot printing through Search Engines, Web Services, Social Networking Sites, Website, Email, Competitive Intelligence, Foot printing through Social Engineering, Foot printing Tools, Network Scanning Concepts, Port-Scanning Tools, Scanning Techniques, Scanning Beyond IDS and Firewall

Module 3: ENUMERATION AND VULNERABILITY ANALYSIS   (09 Periods)
Enumeration Concepts, NetBIOS Enumeration, SNMP, LDAP, NTP, SMTP and DNS Enumeration, Vulnerability Assessment Concepts, Desktop and Server OS Vulnerabilities, Windows OS Vulnerabilities, Tools for Identifying Vulnerabilities in Windows, Linux OS Vulnerabilities, Vulnerabilities of Embedded Oss.

Module 4: SYSTEM HACKING   (10 Periods)
Hacking Web Servers, Web Application Components, Vulnerabilities, Tools for Web Attackers and Security Testers Hacking Wireless Networks, Components of a Wireless Network, Wardriving, Wireless Hacking, Tools of the Trade.

Module 5: NETWORK PROTECTION SYSTEMS   (07 Periods)
Access Control Lists, Cisco Adaptive Security Appliance Firewall, Configuration and Risk Analysis Tools for Firewalls and Routers, Intrusion Detection and Prevention Systems, Network, Based and Host-Based IDSs and IPSs, Web Filtering, Security Incident Response Teams, Honeypots.

Total Periods: 45

EXPERIENTIAL LEARNING

1. List out various ways used to Protect Yourself from Hackers.
2. Demonstrate how do White Hackers work?
3. Demonstrate The bug bounty program.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, and James E. Corley, *Hands-On Ethical Hacking and Network Defense, Course Technology*, Delmar Cengage Learning, 2010.
2. Patrick Engebretson, *The Basics of Hacking and Penetration Testing*, SYNGRESS, Elsevier, 2013.

REFERENCE BOOKS:

1. Dafydd Stuttard and Marcus Pinto, *The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws*, Wiley, 2nd Edition, 2011.
2. Justin Seitz, *Black Hat Python: Python Programming for Hackers and Pentesters*, 2nd Edition, 2014.

VIDEO LECTURES:

1.   https://www.coursera.org/learn/ethical-hacking-essentials-ehe
2.   https://www.udacity.com/course/ethical-hacker-nanodegree--nd350

WEB RESOURCES:

1.   https://github.com/PacktPublishing/Python-Ethical-Hacking
2.   https://www.youtube.com/watch?v=x3IwvPvDpKE

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101703	**FORENSIC SCIENCE**	3	-		-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Concepts of Forensic Science, Tools and Techniques in Forensic Science, Forensic Photography, Crime Scene Management, Crime Scene Management Laws and Forensic Science.

COURSE OUTCOMES: *After successful completion of the course, students will be able to*:

CO1 Understand the basic concepts of Forensic science.

CO2 Apply various tools and techniques in forensic science for crime investigation.

CO3 Understand Forensic Photography fundamentals.

CO4 Perform Crime scene investigation, scene reconstruction and prepare reports.

CO5 Understand Legal aspects of Forensic Science.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	2	2	-	-	-	-	-	-	-
CO5	3	3	2	2	2	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION *(09 Periods)*

Introduction, Need, Scope, Concepts and Significance of Forensic Science, History and Development of Forensic Science, Laws and Basic principles of Forensic Science, Branches of forensic science, Organizational set-up of a Forensic Science Laboratory. Investigative strategies. Expert testimony and eye-witness report.

Module 2: TOOLS AND TECHNIQUES IN FORENSIC SCIENCE *(09 Periods)*

Basic principles of microscopy, spectroscopy, chromatography, Electrophoresis, Enzyme_Linked Immunosorbent Assay (ELISA), Radio Immuno Assay (RIA). Measuring and optical instruments. Research methodologies; Formation of research design on a specific problem. Central tendency and Dispersion. Test of significance. Analysis of variance, Correlation and Regression.

Module 3:   FORENSIC PHOTOGRAPHY   *(8 Periods)*

Basic principles of Photography, Techniques of black & white and color photography, cameras, lenses, shutters, depth of field, film; exposing, development and printing techniques; Different kinds of developers and fixers; UV, IR, fluorescence illumination guided photography; Modern development in photography- digital photography, working and basic principles of digital photography; Surveillance photography. Videography and Crime Scene & laboratory photography.

Module 4:   CRIME SCENE MANAGEMENT   *(11 Periods)*

Crime scene investigations, protecting and isolating the crime scene; Documentation, sketching, field notes and photography. Searching, handling and collection, preservation and transportation of physical evidences, Chain of custody and Reconstruction of scene of crime. Report writing.

Module 5:   LAW AND FORENSIC SCIENCE   *(8 Periods)*

Legal aspects of Forensic Science: Forensic Science in the Criminal Justice System, The Criminal Investigation Process, Production of Evidence: The Subpoena, The Rules of Evidence, Authentication of Evidence: The Chain of Custody, The Admissibility of Evidence, Laboratory Reports, Examples of Analysis and Reports, Expert Testimony, Getting into Court, Testifying, Being a Witness and an Expert, Considerations for Testimony.

Total Periods: 45

EXPERIENCIAL LEARNING
1.   Study of Computer Forensics and different tools used for forensic investigation
2.   **Identify and list the steps for hiding and extract any text file behind an image file/ Audio file using Command Prompt**

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES
TEXT BOOKS:

1. Houck M.M and Siegel J.A, *Fundamentals of Forensic Science*, Elsevier, 2nd edition, 2010.
2. Sharma B.R, *Forensic Science in Criminal Investigation and Trials*, Universal Publishing Co., New Delhi, 2003.

REFERENCE BOOKS:

1. Nanda B.B and Tewari, R.K, *Forensic Science in India- A vision for the Twenty First Century*, Select Publisher, New Delhi, 2001.
2. James, S.H and Nordby, J.J, *Forensic Science- An Introduction to Scientific and Investigative Techniques*, CRC Press, USA, 2003.
3. Saferstein, Criminalistics, *An Introduction of Forensic Science*, Prentice Hall Inc, USA,2007.
4. Barry, A.J. Fisher, *Techniques of Crime Scene Investigation*, CRC Press, NewYork, 7th edition, 2003.

VIDEO LECTURES:

1.   https://nptel.ac.in/courses/106106178

2. https://www.youtube.com/watch?v=X5fo1H7bc0g

WEB RESOURCES:

1. https://www.nist.gov/forensic-science

2. https://www.coursera.org/learn/forensic-science

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22SS101702	**GENDER AND ENVIRONMENT**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Gender and the environment relationship, Gendered Roles in the Family & Community, Gender and sustainable development, Gender in environmental justice, Gender & Environmental Security.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Apply the knowledge of gender & environmental connections by analyzing key issues and topics within global environmental politics in environmental decision-making.

CO2 Demonstrate knowledge of the concepts of gender and sustainable development through debates and policy documents.

CO3 Analyze the concept of environmental security and justice by identifying the sources of insecurity.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	-	-	-	3	3	-	-	-	-	-
CO2	3	-	-	-	-	2	3	1	-	2	-	-
CO3	3	1	-	-	-	3	3	-	-	-	-	2
Course Correlation Mapping	**3**	**1**	**-**	**-**	**-**	**3**	**3**	**1**	**-**	**2**	**-**	**2**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: GENDER AND ENVIRONMENT RELATIONSHIP *(09 Periods)*

Introduction – Gender and Environment – Development of gender roles – Society, gender & environment – Understanding environmental politics – Gender-environment connections–Eco-feminism – Cultural eco-feminism – Social eco-feminism – Feminist political ecology

Module 2: GENDERED ROLES IN THE FAMILY & COMMUNITY *(09 Periods)*

Organization of the household – Domestic division of labour – Food: growing, harvesting, shopping, preparing, and cooking

Gender & Power – Planning – Politics – NGO – Gendering of environmental protest – Environmental decision-making

Module 3: GENDER AND SUSTAINABLE DEVELOPMENT   *(09 Periods)*

Concept of sustainability & its achievement – Concept of sustainable development – Ecological Modernization – Gender & sustainability debates – Gender & sustainable development debates - Gender in policy documents – Gender, poverty & equity in sustainable development

Module 4: GENDER IN ENVIRONMENTAL JUSTICE   *(09 Periods)*

Normative Concerns (Fairness, Inequality & Justice) –Making sense of Environmental justice – Ecological debt, Transnational harm, & human rights – Ecological justice – Gender &Environmental Justice – Gender, Vulnerability & risk – Women in environmental justice movements – Knowledge & participation – Gender, sustainability & justice as guiding concepts.

Module 5: GENDER AND ENVIRONMENTAL SECURITY   *(09 Periods)*

Connections between security & the environment – **Gender, environment & security:** Sustainability as security – poverty & insecurity – Insecurity as injustice – Competing ways of thinking security – Reflecting on sources of insecurity – **Case Study** – Food Security -**Case Study** – The impacts of natural disasters

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare a poster presentation on the impact of globalization on family structure and society.
2. Prepare a presentation on the family setup of different countries and their peculiar customs.
3. Prepare poster presentation on "Ancient hominin walked like a human but climbed like an ape."
4. Find out the problems of present society and being part of future generations how you may help to strengthen environmental security.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Nicole Detraz, *Gender and the Environment,* Polity Press, Cambridge, UK. 2017
2. Susan Buckingham- Hatfield, *Gender and Environment*, Routledge, London. 2000

REFERENCE BOOKS:

1. Promillakapur ed., *Empowering Indian Women*, Publication Division, Government of India, New Delhi. 2000.
2. Ronnie Vernooy, Ed., *Social and Gender Analysis Natural Resource Management: Learning Studies and Lessons from Asia,* Sage, New Delhi. 2006
3. Swarup Hemlata and Rajput, Pam, *Gender Dimensions of Environmental and Development Debate: The Indian Experience,* In Sturat S. Nagel, (ed). *India's Development and Public Policy*. Ashgate, Burlington. 2000

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22ME101701	**GLOBAL STRATEGY AND TECHNOLOGY**	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION:
Introduction to strategic management; Strategic management process; Principles of good strategy; Globalization strategies; Research and Development strategies; Technology Management and Transfer; Elements of Transfer Process; Corporate Governance in the Indian scenario.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1 Demonstrate the knowledge on strategic management, its approaches, and tools through ethical decision making.
CO2 Analyse the globalization challenges for scrupulous selection of globalization strategies.
CO3 Apply the R&D strategies and trends to enhance the technological breakthroughs for new products and applications.
CO4 Demonstrate the knowledge on technology management and transfer that strengthen the economy and accelerate the application of technology and resources.
CO5 Analyze the challenges of corporate governance in Indian scenario for the effective development of value-oriented organizations.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	1	-	1	1	-	1	-	-	1	-
CO2	3	2	1	-	1	1	-	-	-	-	1	-
CO3	3	2	1	-	1	1	-	-	-	-	1	-
CO4	3	2	1	-	1	1	-	-	-	-	1	-
CO5	3	2	1	-	1	1	-	1	-	-	1	-
Course Correlation Mapping	**3**	**2**	**1**	**-**	**1**	**1**	**-**	**1**	**-**	**-**	**1**	**-**

Correlation Levels: **3: High;**   **2: Medium;**   **1: Low**

COURSE CONTENT
Module 1:   STRATEGIC MANAGEMENT   (09 Periods)
Introduction, Classes of decisions, Levels of strategy, Core competence, Strategic intent and stretch, Approaches to strategy making, Roles of different strategists, Strategic Management-Process, Benefits, Limitations; Ethics in strategic decision making, Principles of good strategy, Strategic Management in India; Common managerial strategy formulation tools.

Module 2:   GLOBALIZATION   (09 Periods)
Definition, Stages, Essential conditions for globalization, Globalization strategies, Competitive advantage of Nations and regions, Factors affecting Globalization, Globalization of Indian

business.

Module 3: RESEARCH & DEVELOPMENT STRATEGIES (09 Periods)
Concept, Evolution of R and D Management, R and D as a business, R and D as competitive advantage, Elements of R and D strategies, Integration of R and D, Selection and implementation of R and D strategies, R and D trends and challenges.

Module 4: TECHNOLOGY MANAGEMENT AND TRANSFER (09 Periods)
Technology Management: Introduction, Technology-Definition, Components, Classification Features; Technology Management-Concept, Nature; Drivers of Management of Technology-Significance, Scope, Responding to technology challenges.
Technology Transfer: Introduction, Definition, Classification, Significance, Elements of process, Types of Technology Transfer, Package, Modes of Transfer, Routes, Channels and Effectiveness of Technology Transfer.

Module 5: CORPORATE GOVERNANCE: THE INDIAN SCENARIO (09 Periods)
Emergence of corporate governance in India-Landmarks, Models, Codes and status in India, Role and Responsibilities of Regulators, The Board of Directors; Corporate Governance- Specific issues in India, Family-owned Business, Corporate Governance and the Indian ethos.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Case studies: Using real-world examples of global businesses and their technological strategies, students can examine the challenges and opportunities presented by different markets and technologies. This can involve analyzing data, conducting market research, and making decisions based on their findings.

2. Simulation games: Students can participate in simulation games that allow them to make decisions about global strategy and technology in a virtual environment. This can help them understand the complexities of international business, such as navigating different cultures, regulations, and economic systems.

3. Industry partnerships: Partnerships with technology companies and global businesses can provide students with hands-on experience in global strategy and technology. This can include internships, shadowing, or working on real projects with industry professionals.

4. Project-based learning: Students can work on real-world projects that require them to apply their knowledge of global strategy and technology. This can include developing a business plan for a new product or service, designing a marketing campaign for a global audience, or analyzing the impact of a new technology on a specific industry.

5. Field trips: Visiting international businesses or attending technology conferences can provide students with a first-hand look at global strategy and technology in action. This can help them understand the challenges and opportunities of different markets and technologies, as well as connect with industry professionals.

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

CASE STUDIES:
1. Tesla: Can Elon Musk's electric car company succeed globally?
2. Uber: How the ride-sharing giant is expanding its global footprint.
3. Alibaba: How China's e-commerce giant is competing on the global stage.
4. Airbnb: How the home-sharing platform is disrupting the global hotel industry.

5. Netflix: How the streaming service is expanding globally and adapting to local markets.

ARTICLES:
1. "Digital Transformation: Why it Matters for Global Business" by Forbes
2. "How AI is Changing Global Business Strategy" by Harvard Business Review
3. "The Future of Globalization: Exploring the Role of Technology" by World Economic Forum
4. "Globalization 4.0: What it Means for Technology and Strategy" by McKinsey & Company
5. "How Technology is Transforming Global Supply Chains" by MIT Sloan Management Review

RESOURCES

TEXT BOOKS:

1. Francis Cherunilam, *Strategic Management*, Himalaya Publishing House, 3rdEdition, 2002.

2. C. S. G. Krishnamacharyulu and Lalitha Ramakrishnan, *Management of Technology*, Himalaya Publishing House, Second Edition, 2012.

REFERENCE BOOKS:

1. White and Bruton, *The Management of Technology and Innovation: A Strategic Approach*, Cengage Learning, 1stEdition, 2007.
2. S.K.Mandak, *Ethics in Business and Corporate Governance*, TMH, 2ndEdition, 2012.

VIDEO LECTURES:

1. https://www.digimat.in/nptel/courses/video/110106157/L01.html
2. https://www.digimat.in/nptel/courses/video/110106157/L43.html

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22EE101704	**GREEN TECHNOLOGIES**	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on green technology concepts, the role of industry and government in establishing green energy footprints and cleaner development mechanisms. It also presents energy-efficient and sustainable green production systems, concepts of energy ecosystems, and concepts of green buildings.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Understand the green technology concepts and the consequences of greenhouse gas emissions.
CO2. Acquire basic knowledge on cleaner development mechanism, the importance of re-use of materials, and the oxidation technology for wastewater.
CO3. Go beyond energy-efficient machinery, biofuels, and environmentally friendly materials.
CO4. Acquire basic knowledge on man-made ecosystems, sources, and control of pollution.
CO5. Understand the concepts and requirements for green buildings.

CO-PO Mapping Table

Course Outcome	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	3	-	-	-	-	1
CO2	3	-	-	-	-	-	3	-	-	-	-	1
CO3	3	-	-	-	-	-	3	-	-	-	-	1
CO4	3	-	-	-	-	-	3	-	-	-	-	1
CO5	3	-	-	-	-	-	3	-	-	-	-	1
Course Correlation Mapping	**3**	**-**	**-**	**-**	**-**	**-**	**3**	-	-	-	**-**	**1**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO GREEN TECHNOLOGY   *(09 Periods)*
Green technology-definition, importance, factors affecting green technology. Global atmosphere-green house gases, global warming, acid rain, ozone depletion and photochemical smog. Role of industry, government and institutions; industrial ecology, role of industrial ecology in green technology.

Module 2:   CLEANER DEVELOPMENT TECHNOLOGIES   *(08 Periods)*
Cleaner development mechanisms, role of industry; reuse, reduce and recycle, raw material substitution; wealth from waste; carbon credits, carbon trading, carbon sequestration, eco labeling. Oxidation technology for wastewater treatment - cavitation, fenton chemistry, photocatalysis and hybrid processes.

Module 3:   ENERGY EFFICIENT SYSTEMS AND PROCESSES   *(09 Periods)*
Energy efficient motors, energy efficient lighting, control and selection of luminaries; bio-fuels, fuel cells- working, selection of fuels, Green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of sustainable

green production systems.

Module 4:   ENERGY ECOLOGY AND ENVIRONMENT   *(08 Periods)*

Concept and theories of ecosystems - energy flow in major manmade ecosystems- agricultural, industrial and urban ecosystems - sources of pollution from energy technologies and its impact on atmosphere - air, water, soil, and environment - environmental laws on pollution control – innovation and sustainability: - eco-restoration / phyto-remediation, renewable energy technologies, industrial ecology and agro ecology.

Module 5:   GREEN BUILDINGS   *(10 Periods)*

Definition- Features and benefits, Fundamental planning decisions for energy efficient building-site selection, buildings forms and orientations, building fabrics and insulation, ventilation, passive solar features. Eco-friendly and cost effective materials, energy management. Rooftop solar photovoltaic system and solar tracking system, alternating roofing systems.

Total Periods: 45

EXPERIENTIAL LEARNING

1. The student shall prepare a report on the causes of global warming and should suggest possible remedies for reducing the global warming
2. The student shall prepare a report on the wastewater management system.
3. The student shall prepare a report on controlling pollution in the environment.
4. The student shall observe the various considerations in a greenhouse building and should prepare the report on the observations made and should suggest possible avenues for improvement.

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

RESOURCES

TEXT BOOKS:

1. Khan B.H, *Non conventional energy resources*, Tata McGraw-Hill, New Delhi 2006.
2. Paul L. Bishop, *Pollution prevention –Fundamentals and Practices*, McGraw-Hill-international 2000.

REFERENCE BOOKS:

1. P. Aarne Veslind, *Introduction to environmental engineering*, Cenage Learning 2010.
2. Joseph A. Salvato, *Environmental engineering,* Wiley
3. Tom D Reynolds, *Unit operations and processes in environmental engineering*, PWS Publishing.
4. D. Y. Goswami, F. Kreith and J. F. Kreider, *Principles of Solar Engineering*, Taylor and Francis.
5. C. S. Solanki, *Solar Photovoltaics: Fundamental Applications and Technologies*, Prentice Hall.

WEB RESOURCES:

1. N. Vinutha bai, R. Ravindra, Energy efficient and green technology concepts, International Journal of Research in Engineering and Technology p 253-258, Volume: 03 Special Issue: 06, 2014, eISSN: 2319-1163 pISSN: 2321-7308.

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22ME101702	**HUMAN RESOURCE MANAGEMENT**	3	-	-	-	3

Pre-Requisite –
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION:
Concepts of HRM; Environmental Scanning; Human Resource Planning; Job analysis; Job design; Job evaluation; Recruitment; Selection; Placement; Orientation; Training and Development; Performance appraisal; Merit rating; Compensation; Industrial relations; Trade unions; Industrial disputes; Ethical issues; Employee safety.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1. Demonstrate the knowledge on the principles, processes and practices of human resource management.
CO2. Analyze the key issues related to administering the human elements such as motivation, recruitment, training and development, compensation, appraisal, and career development.
CO3. Provide solutions to plan and manage human resource functions effectively within organization.
CO4. Apply HRM concepts and techniques in strategic planning to improve organizational effectiveness.
CO5. Evaluate HRM related social, cultural and safe responsibilities and issues in a global context.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	1	1	-	1	-	-	-	-	-	-
CO2	3	3	1	1	-	1	-	-	-	-	-	-
CO3	3	2	3	1	-	-	-	-	-	-	-	-
CO4	2	1	1	1	3	1	-	-	-	-	-	-
CO5	3	1	1	1	1	1	2	3	-	-	-	-
Course Correlation Mapping	3	2	1	1	2	2	2	3				

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO HRM & HRP   (09 Periods)
Introduction to Human Resource Management (HRM): Objectives, Scope and significance of HRM, Functions of HRM, Prospects in HRM, Environmental scanning.

Human Resource Planning (HRP): Introduction, Nature and importance of HRP, Factors affecting HRP, The planning process, Human resource planning and the Government, Requisites for successful HRP, Barriers to HRP.

Module 2:   RECRUITMENT AND PLACEMENT   *(09 Periods)*

Job Analysis – Nature and process of job analysis, Methods of collecting job data, Potential problems with job analysis, Requisites for job analysis; Job Design - Factors, Job design approaches, Contemporary issues; Job evaluation - Process, Methods; Recruitment - Nature, Purposes and importance, Factors governing recruitment, Recruitment process, Evaluation and control; Selection – Nature, Process, Barriers to effective selection, Evaluation of selection process, Placement; Separation.

Module 3:   HUMAN RESOURCE DEVELOPMENT AND COMPENSATION   *(09 Periods)*

Orientation - Orientation programme, Requisites of an effective programme, Evaluation of orientation programme, Problems of orientation; Training and development – Nature, Inputs, Training process, Methods, Impediments to effective training, Management development, Career development, Talent management; Performance Appraisal - Nature, Appraisal process, Challenges of performance appraisal; Merit rating; Compensation - Philosophy, Components, Theories, Factors influencing employee compensation, Challenges, Wage and salary administration.

Module 4:   INDUSTRIAL RELATIONS AND TRADE UNIONS   *(09 Periods)*

Industrial Relations (IR): Nature of IR, Importance of Peaceful IR; Approaches to IR - Unitary Approach, Pluralistic approach, Marxist approach; Parties to IR; IR strategy; Industrial Disputes - Nature, Causes, and Settlement.

Trade unions: Nature of trade unions, Strategic choices before unions, Union tactics, Trade union movement in India, Trends in trade union movement, Managing unions; Indian Factories Act; Employee's compensation Act; Industrial disputes Act.

Module 5:   ETHICAL ISSUES AND SAFETY ADMINISTRATION   *(09 Periods)*

Managing Ethical Issues in HRM: Nature of ethics, Sources of business ethics, Myths about ethics, Ethical dilemmas, HR ethical issues, Managing ethics, Improving ethical decision making.

 Employee Safety: Safety, Need for safety, Types of accidents, Safety programme, ISO safety standards.

                                                    Total Periods: 45

EXPERIENTIAL LEARNING

1.   What are the challenges that are faced by HR in effective performance management including performance appraisal in MNCs? Discuss in detail in the contemporary of HRM.
2.   Evaluate employee relations in a comparative perspective across few countries of your choice. Describe in brief by taking a case study.
3.   Visit an organization or industry and Evaluate HRM related social, cultural, ethical and environmental responsibilities and issues in a global context.

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

RESOURCES

TEXT BOOKS:

1.   Aswathappa K, *Human Resource Management,* Tata McGraw Hill Private Limited, 8th edition, 2017.
2.   Garry Dessler and Biju Varkkey, *Human Resource Management,* Pearson India, 16th Edition, 2020.

REFERENCE BOOKS:

1. Raymond A. Noe, John R. Hollenbeck, *HRM: Gaining a Competitive Advantage*, TMH, 7th edition, 2010.
2. Bohlander George W, Snell Scott, *Principles of Human Resource Management,* Cengage Learning, 16th edition, 2016.
3. Edwin B. Flippo, *Personnel Management,* McGraw-Hill International editions, 6th edition, 1984.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/122105020
2. https://onlinecourses.nptel.ac.in/noc20_mg15/preview
3. https://www.digimat.in/nptel/courses/video/122105020/L01.html

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22SS101703	**INDIAN ECONOMY**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Introduction; Elementary Economic Analysis; Economic Planning; Time Value of Money; Value Analysis/Value Engineering.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understand the basic concepts of economics, economic analysis, economic planning and strata.

CO2 Demonstrate knowledge in capital budgeting, evaluation of engineering projects, depreciation policy and familiarize with the concepts of value analysis vs value engineering.

CO3 Analyze and apply financial information for the evaluation of finance.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	2	-	-	-	-	-	-
CO2	3	-	-	-	-	2	-	-	-	-	-	2
CO3	3	-	-	-	-	2	-	-	-	-	-	2
Course Correlation Mapping	3	-	-	-	-	2	-	-	-	-	-	2

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION   *(09 Periods)*

Economics-Flow in an Economy, Law of Supply and Demand; Micro and Macro Economics; Relationship between Science, Engineering, Technology and Economic Development; Concept of Engineering Economics-Types of Efficiency, Definition and Scope of Engineering Economics.

Module 2:   ELEMENTARY ECONOMIC ANALYSIS   *(09 Periods)*

Economic Analysis – Meaning, Significance, Simple Economic Analysis; Material Selection for a Product, Substitution of Raw Material; Design Selection for a Product; Material Selection-Process Planning, Process Modification.

Module 3:   ECONOMIC PLANNING   *(09 Periods)*

Introduction - Need For Planning in India, Five-year plans(1951-2012), NITI Aayog (from 2014 onwards); Inclusive Growth-Meaning, Significance, Need for inclusive growth in India, Strategy for more inclusive growth, Challenges and Prospects; Employment and Inclusive Growth in India, Role of engineers in sustaining inclusive growth.

Module 4:   TIME VALUE OF MONEY   *(12 Periods)*

Concepts and Application; Capital Budgeting-Traditional and Modern Methods; Simple and Compound Interest, Cash Flow Diagram, Principle of Economic Equivalence; Evaluation of Engineering Projects - Present Worth Method, Future Worth Method, Annual Worth Method, Internal Rate of Return Method, Cost-benefit Analysis in Public Projects; Depreciation Policy-Depreciation of Capital Assets, Causes of Depreciation, Straight Line Method and Declining Balance Method.

Module 5:   VALUE ANALYSIS/VALUE ENGINEERING   *(06 Periods)*

Introduction-Value Analysis, Value Engineering, Functions, Aims; Value Analysis vs Value Engineering; Value Engineering Procedure- Advantages, Application Areas.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare a poster presentation on the impact of globalization on family structure and society.
2. Prepare a presentation on family setups of different countries and their peculiar customs if any.
3. Prepare a poster presentation on "Ancient hominin walked like a human but climbed like an ape."
4. Find out the problems of present society and being part of future generations and how you may help to strengthen environmental security.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Panneerselvam. R., *Engineering Economics*, PHI Learning Private Limited, New Delhi, 2nd edition, 2013.
2. Jain. T. R., V. K. Ohri, O. P. Khanna., *Economics for Engineers*, VK Publication, 1st edition, 2015.

REFERENCE BOOKS:

1. DuttRudar & Sundhram K. P. M., *Indian Economy*, S. Chand, New Delhi, 62nd revised edition, 2010.
2. Misra, S. K. & V. K. Puri., *Indian Economy*: *Its Development Experience*, Himalaya Publishing House, Mumbai, 32nd edition, 2010.

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22SS101704	**INDIAN HISTORY**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Introduction; Ancient India; Classical and Medieval era; Modern India; India after independence.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate contextual knowledge in the evolution of ancient and medieval Indian History and acquire an awareness of societal and cultural transformation.

CO2 Analyze the situations before and after Independence and assess the societal reforms implemented in India after Independence.

CO3 Practice culture transformations and appreciate its influence to adapt themselves in global scenarios.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	-	-	-	-	1	-	-	-	-	-	-
CO2	1	2	-	-	-	1	-	-	-	-	-	-
CO3	1	1	-	-	-	2	-	-	-	-	-	-
Course Correlation Mapping	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO INDIAN HISTORY   *(08 Periods)*

Elements of Indian History; History Sources: Archaeology, Numismatics, Epigraphy & Archival research; Methods used in History; History & historiography; Sociological concepts-structure, system, organization, social institutions, Culture and social stratification (caste, class, gender, power), State& Civil Society.

Module 2:   ANCIENT INDIA   *(09 Periods)*

Mohenjo-Daro civilization; Harappa civilization; Mauryan Empire.

Module 3:   CLASSICAL & MEDIEVAL ERA   *(12 Periods)*

Classic Era (200 BC - 1200 AD); Hindu - Islamic Era (1200 - 1800 AD).

Module 4:   MODERN INDIA   *(06 Periods)*

Age of Colonialism (17th - 19th centuries); First war of Indian Independence; Freedom Struggle (1857-1947)

Module 5:   INDIA AFTER INDEPENDENCE (1947 -)   *(10 Periods)*

The Evolution of the Constitution and Main Provisions; Consolidation of India as a Nation; Politics in the States; Indian economy; Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and Inclusion, Changing Nature of Work and Organization.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare a write-up on how to safeguard ancient monuments.

2. Analyze the most famous historically important place you visited.

3. Prepare a presentation on the ancient Seven Wonders of the World with their significance and how they are destroyed.

4. Prepare a presentation on "Wars of the past not only destroyed people and their livelihood but also the people's tradition and culture."

5. Prepare a poster on " Continents that No Longer Exist" with causes

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. K. Krishna Reddy, *Indian History,* Tata McGraw-Hill, 21st reprint, 2017.

REFERENCE BOOKS:

1. Guha, Ramachandra, *India after Gandhi*, Pan Macmillan, 2007.

2. Romila Thapar, *Early India*, Penguin India, New Delhi 2002.

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22SS101705	**INDIAN TRADITION AND CULTURE**	3	-	-	-	3

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: Basic traits of Indian Culture; Humanistic Reforms under Jainism and Buddhism; Culture in the medieval period; Socio Religious reforms in Indian Culture; Reform movements for harmonious relations.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Demonstrate knowledge of Vedic and Upanishadic culture and society to consider human aspirations, values and theories.

CO2 Understand the contributions of Buddhism and Jainism to Indian culture.

CO3 Examine the cultural conditions and achievements of India under Mouryas and Guptas.

CO4 Analyze social religious reforms and reform movements.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	1	-	-	-	-	-	-
CO2	3	-	-	-	-	1	-	-	-	-	-	2
CO3	2	-	-	-	-	3	-	-	-	-	-	-
CO4	2	-	-	-	-	3	-	-	-	-	-	2
Course Correlation Mapping	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   BASIC TRAITS OF INDIAN CULTURE   *(08 Periods)*

Meaning and definition and various interpretations of culture - Culture and its features - The Vedic and Upanishad culture and society - Human aspirations and values in these societies - Chaturvidha purushardhas, Chaturashrma and Chaturvarna theory.

Module 2:   HUMANISTIC REFORMS UNDER JAINISM AND BUDDHISM   *(09 Periods)*

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Salient features of Jainism - contributions of Jainism to Indian culture - Contributions of Aachaarya and Mahaapragya - Buddhism as a humanistic culture - The four noble truths of Buddhism - Contributions of Buddhism to Indian culture.

Module 3:   CULTURE IN THE MEDIEVAL PERIOD   *(09 Periods)*

Unifications of India under Mouryas and Guptas and their cultural achievements - Cultural conditions under satavahanas - Contributions to Pallavas and cholas to art and cultural achievements of Vijayanagara rulers

Module 4:   SOCIO RELIGIOUS REFORMS IN INDIAN CULTURE   *(09 Periods)*

Western impact on India - Introduction of Western education - social and cultural awakening and social reform movements of Rajaramohan Roy - Dayanandha Saraswathi - Anne Besant (theosophical society).

Module 5:   REFORM MOVEMENTS FOR HARMONIOUS RELATIONS   *(09 Periods)*

Vivekananda, Eswarchandravidyasagar and Veeresalingam - emancipation of women and struggle against caste - Rise of Indian nationalism - Mahatma Gandhi – Non-violence and satyagraha and eradication of untouchability.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Identify different cultural festivals of Indian States and prepare a write-up on their uniqueness.
2. India has a rich history with numerous architectural wonders. Prepare a report on any three famous architectural wonders in India.
3. Explore the diverse flavors of Indian cuisine and prepare a poster on the different dishes and their distinctiveness.
4. India is a country of Unity in Diversity. Make a PowerPoint presentation on different traditional dresses of various cultural people.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. Valluru Prabhakaraiah, *Indian Heritage and Culture*, Neelkamal Publications Pvt. Ltd. Delhi, 1/e, reprint 2015.

REFERENCE BOOKS:

1. L. P. Sharma, *History of Ancient India*, Konark Publishers, Pvt. Ltd. New Delhi, 2010.
2. L. P. Sharma, *History of Medieval India*, Konark Publishers, Pvt. Ltd. New Delhi, 2010.
3. The Cultural Heritage of India Vol-I, II, III, IV, V, The Ramakrishna Mission Institute of Culture, Calcutta

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UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22EC101703	**INSTRUMENTATION IN INDUSTRIES**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on measurement of various parameters like displacement, force, torque, acceleration, velocity, density, viscometer, hygrometers, temperature, pressure, level and flow.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Select appropriate displacement, force and torque measuring devices for specific measurement application.

CO2 Identify suitable acceleration, velocity and density measuring devices for specific measurement application.

CO3 Apply suitable viscometer and hygrometer for measurement of viscosity, humidity and moisture for a specific application.

CO4 Select appropriate temperature and pressure transducer for an industrial requirement.

CO5 Identify appropriate level and flow transducer for measurement of level and flow for a specific application.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	3	-	-	-	-	-	-	-	-
CO2	3	2	-	3	-	-	-	-	-	-	-	-
CO3	3	2	-	3	-	-	-	-	-	-	-	-
CO4	3	2	-	3	-	-	-	-	-	-	-	-
CO5	3	2	-	3	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT

Module 1:   DISPLACEMENT, FORCE & TORQUE MEASUREMENT   *(08 Periods)*

Displacement Measurement: Introduction, Strain gauge, LVDT, Capacitive Gauges and applications.
Force Measurement: Introduction, Analytical Balance, Spring Balance, Load cells.
Torque Measurement: Introduction, Strain gauge, Relative angular twist and applications.

Module 2:   ACCELERATION, VELOCITY & DENSITY MEASUREMENT   *(08 Periods)*

Acceleration Measurement: Introduction, LVDT, Piezoelectric, Strain gauge and Variable reluctance type accelerometers and applications.
Velocity Measurement: Introduction, Revolution Counter, Capacitive Tacho, Drag-cup Type, Tacho and Stroboscope and applications.
Density Measurement: Introduction, Pressure type densitometers, Float type densitometers, Ultrasonic densitometer and gas densitometer.

Module 3:   VISOCITY, HUMIDITY & MOISTURE MEASUREMENT   *(09 Periods)*

Viscosity Measurement: Introduction, friction tube viscometer, say bolt's viscometer, rotameter viscometer, Searle's rotating cylinder, cone and plate viscometer.
Humidity Measurement: Introduction, Dry and wet bulb psychrometers, Resistive and capacitive type hygrometers
Moisture Measurement: Introduction, Thermal Conductivity and Capacitive sensors, Applications of moisture measurement, Moisture measurement in solids.

Module 4:   TEMPERATURE & PRESSURE MEASUREMENT   *(10 Periods)*

Temperature Measurement: Definitions and standards, RTD, Thermistor, Thermocouples: Laws of thermocouple, Reference junctions compensation, Radiation fundamentals, Radiation methods of temperature measurement, Total radiation pyrometers, Optical pyrometers, Applications.
Pressure Measurement: Introduction, manometer and its types, elastic transducers Bourdon tube, diaphragm, bellows, electrical types, resistive, inductive and capacitive, Thermal conductivity gage, Ionization gage, Sound level meter, Microphone, Applications.

Module 5:   LEVEL & FLOW MEASUREMENT   *(10 Periods)*

Level Measurement: Introduction, Gauge Glass technique, Float Types – Float–and– tape method, Float–and–shaft method, Magnetic float types. Electrical types – Resistance switch type, Inductive and Capacitance type. Ultrasonic methods. Applications
Flow Measurement: Introduction, Head types – Orifice, Venturi, Flow Nozzle. Rotameter & types. Coriolis flow meter, Gyroscopic flow meter, Liquid bridge mass flow meter, Calorimetric flow meter. Electromagnetic flow meter, Ultrasonic flow meter, Hotwire anemometer type. Applications.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Record temperature from RTD and convert temperature in to voltage.

2. Measure the speed of rotating shaft using stroboscope.

3. Record level of the tank using suitable device.

4. Measure the flow rate of water in boiler plant.

5. Measure the displacement using LVDT.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. K. Sawhney, *A Course in Electrical and Electronics Measurements and Instrumentation*, Dhanpat Rai and Sons, New Delhi, 19th Revised Edition, 2013

2. D. Patranabis, *Principles of Industrial Instrumentation*, TMH, 3rd Edition, 2010.

REFERENCE BOOKS:

1. Ernest Doebelin & Dhanesh Manik, *Measurement Systems*, McGraw Hill International, 6th Edition, 2011.

VIDEO LECTURES:

1. https://www.vlab.co.in/

2. https://archive.nptel.ac.in/courses/103/103/103103135/

3. https://nptel.ac.in/courses/103103135

WEB RESOURCES:

1. https://www.tutorialspoint.com/electronic_measuring_instruments/index.htm

2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108105064/lec1.pdf

3. https://www.ibiblio.org/kuphaldt/socratic/sinst/book/liii.pdf.

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22EC101704	**INTRODUCTION TO NANOTECHNOLOGY**	3	-	-	-	3

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: The fundamental principles of nanoelectronics and the utilization of nanostructures as nano electronic devices.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the basic knowledge in nanoelectronics, crystal structure of semiconducting material various techniques for fabrication and measurement of nanostructure, semiconducting nano electronic devices.

CO2. Analyze Crystal structure of nanomaterials Nanostructure based device

CO3. Design and develop new nano devices for advanced technological applications.

CO4. Capable of solving problems in the field of nanoelectronics.

CO5. Involve and resolve the future research challenges in the fields related to nanoelectronics.

CO6. Apply the environmental context with ethical principle in developing new nano devices.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-
CO4	2	2	2	3	-	-	-	-	-	-	-	-
CO5	3	3	-	-	3	-	-	-	-	-	-	-
CO6	3	-	-	-	-	3	3	2	-	-	-	-
Course Correlation Mapping	3	3	3	3	3	3	3	2	-	-	-	-

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

MODULE-I: INTRODUCTION TO NANOELECTRONICS   *(08 Periods)*

The "Top-Down" Approach, Lithography, The "Bottom-Up" Approach; Why Nanoelectronics? Nanotechnology Potential. The Schr¨odinger wave equation, Wave mechanics of particles, Atoms and atomic orbitals

MODULE II: MATERIALS FOR NANOELECTRONICS   *(09 Periods)*

Semiconductors, Crystal lattices: bonding in crystals, Electron energy bands, Semiconductor heterostructures, Lattice-matched and pseudomorphic heterostructures; Organic semiconductors, Carbon nanomaterials: nanotubes and fullerenes.

MODULE III: FABRICATION AND MEASUREMENT TECHNIQUES FOR NANOSTRUCTURES   *(10 Periods)*

Bulk crystal and heterostructure growth: Nanolithography, etching, and other means for fabrication of nanostructures and nanodevices; Techniques for characterization of nanostructures, Spontaneous formation and ordering of nanostructures; Clusters and nanocrystals, Methods of nanotube growth, Chemical and biological methods for nanoscale fabrication, Fabrication of nanoelectromechanical systems.

MODULE IV : SEMICONDUCTING NANO STRUCTURES   *(09 Periods)*

Time and length scales of the electrons in solids, Statistics of the electrons in solids and nanostructures; The density of states of electrons in nanostructures, Electron transport in nanostructures, Electrons in Quantum well, Quantum wire and Quantum dots.

MODULE V : NANOELECTRONIC DEVICES   *(09 Periods)*

Resonant tunneling diodes, Field effect transistors, Single electron transfer devices, Potential effect transistors, Light emitting diodes and lasers; Nanoelectromechanical system devices, Quantum dot cellular automata.

Total No. of Periods: 45

EXPERIENTIAL LEARNING

1.   Submission of report on specifications of Clean room.
2.   Submission of report on specifications of Clean bench.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, *Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications,* Cambridge University Press, 2012.
2. George W. Hanson, *Fundamentals of Nanoelectronics*, Prentice Hall, 2007

REFERENCE BOOKS:

1. Mitin.V, Kochelap.V and Stroscio.M, *Introduction to Nanoelectronics*, Cambridge University Press, 2008
2. Karl Goser et.al, *Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum devices*, Springer, 2005.

VIDEO LECTURES:

1. Introduction to Nanotechnology, nanohub.org
2. https://nptel.ac.in/courses/103103033

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22AI101702	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE**	3	-	-	-	3

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on Introduction to Artificial Intelligence, Designing intelligent agents, Solving general purpose problems, Search in complex environments, Represent knowledge, Robotics, Ethics.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1   Analyze and Architect intelligent agents using Artificial Intelligence Techniques and principles

CO2   Analyze the usage of Knowledge representation techniques in Artificial Intelligence

CO3   Analyze and interpret the problem, identify suitable solutions using heuristic functions and search algorithms

CO4   Investigate robot hardware and frameworks for intelligent robotic perception.

CO5   Demonstrate knowledge on ethical implications of intelligent machines for providing privacy, trust, security and safety.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	1	-	-	-	-	-	-
CO5	-	-	-	-	-	1	-	2	-	-	-	-
Course Correlation Mapping	3	3	2	-	-	1	-	2	-	-	**-**	**-**

Correlation Levels: 3: High;   2: Medium; 1: Low

COURSE CONTENT

Module 1   INTRODUCTION TO ARTIFICIAL INTELLIGENCE   *(09 Periods)*

Foundations of artificial intelligence, History of artificial intelligence, State of the art, Risks and benefits of AI, Intelligent agents – Agents and environments, The concept of rationality, Structure of agents.

Module 2   KNOWLEDGE & REASONING   *(09 Periods)*

Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.

First-Order Logic - Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.

Module 3   PROBLEM SOLVING BY SEARCHING   *(09 Periods)*

Problem solving agents, Search algorithms, Uninformed search strategies, Informed search strategies – Greedy best-first search, A* search; Heuristic functions.

Module 4   SEARCH IN COMPLEX ENVIRONMENTS   *(09 Periods)*

Local search algorithms and optimization problems – Hill-climbing search, Simulated annealing, Local beam search, Evolutionary algorithms; Optimal decisions in games – The minimax search algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Move ordering; Monte Carlo tree search.

Module 5:   ROBOTICS   *(09 Periods)*

Robots, Robot hardware, Robotic perception, Alternative robotic frameworks, Application domains.

Limits of AI, Ethics of AI – Surveillance, security and privacy, Fairness and bias, Trust and transparency, AI safety

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1. Design and implement agent programs for Table-driven agents using the agent function of vacuum-cleaner world. The agent cleans the current square if it is dirty, otherwise it moves to the other square.
2. Implement agent programs for Simple reflex agents and Model-based reflex agents using the agent function of vacuum-cleaner world.
3. Solve the travelling sales man problem using Hill Climbing search algorithm

(Note: It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXT BOOKS:

1. Stuart Russell, Peter Norvig, *Artificial Intelligence: A Modern Approach*, Prentice Hall, 4th Edition, 2020.

REFERENCE BOOKS:

1. Stephen Lucci, Danny Kopec, *Artificial Intelligence in the 21st Century*, Mercury Learning and Information, 3rd Edition,2018

2. Rich, Knight, Nair*, Artificial intelligence*, Tata McGraw Hill, Third Edition, 2009.

3. Deepak Khemani, *A First Course in Artificial Intelligence*, McGraw Hill Education, 2017.

4. Saroj Kaushik, *Artificial Intelligence*, Cengage Learning, 2011.

SOFTWARE/TOOLS:

1. Python
2. pandas, matplotlib

VIDEO LECTURES:

1. https://searchenterpriseai.techtarget.com/definition/AI-Artificial-Intelligence

2. http://aima.cs.berkeley.edu/

3. https://ai.google/education/

4. https://www.coursera.org/courses?query=artificial%20intelligence

5. https://www.edureka.co/blog/artificial-intelligence-with-python/

WEB RESOURCES:

1. http://www.airesources.org/

2. https://allthingsai.com/

3. https://designmodo.com/ai-tools-designers/

4. https://www.ulethbridge.ca/teachingcentre/chatgpt-ai-resources

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22DS101702	**INTRODUCTION TO DATA SCIENCE**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Introduction to Data Science; Data Collection and Data Pre-Processing, Exploratory Data Analytics, Model Development, and Model Evaluation**.**

COURSE OUTCOMES: *After successful completion of the course, students will be able to*:

CO1. Demonstrate knowledge on Data science concepts.
CO2. Perform data collection and pre-processing.

CO3. Perform exploratory data analytics.

CO4. Design and develop data visualization models.

CO5. Evaluate performance of data models.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	2	2	-	-	-	-	-	-	-
CO3	2	2	2	3	2	-	-	-	-	-	-	-
CO4	2	3	2	2	2	-	-	-	-	-	-	-
CO5	3	2	2	2	2	-	-	-	-	-	-	-
Level of correlation of the course	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: *3: High* *2: Medium* *1: Low*

COURSE CONTENT

Module-1: INTRODUCTION *(09 periods)*
Introduction to Data Science, Evolution of Data Science, Data Science Roles, Stages in a Data Science Project, Applications of Data Science in various fields, Data Security Issues.

Module-2: DATA COLLECTION AND DATA PRE-PROCESSING *(09 periods)*
Data Collection Strategies, Data Pre-Processing- Overview, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization.

Module-3: EXPLORATORY DATA ANALYTICS *(09 periods)*
Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, Box Plots, Pivot Table, Heat Map, Correlation Statistics, ANOVA.

Module-4: MODEL DEVELOPMENT *(09 periods)*

Simple and Multiple Regression, Model Evaluation using Visualization, Residual Plot, Distribution Plot, Polynomial Regression and Pipelines, Measures for In-sample Evaluation, Prediction and Decision Making.

Module-5: MODEL EVALUATION *(09 periods)*

Generalization Error, Out-of-Sample Evaluation Metrics, Cross Validation, Overfitting, Under Fitting and Model Selection, Prediction by using Ridge Regression, Testing Multiple Parameters by using Grid Search.

Total periods: 45

EXPERIENTIAL LEARNING

1. *Use Case:* A human can express his emotions in any form, such as the face, gestures, speech and text. The detection of text emotions is a content-based classification problem. Detecting a person's emotions is a difficult task, but detecting the emotions using text written by a person is even more difficult as a human can express his emotions in any form.

   Recognizing this type of emotion from a text written by a person plays an important role in applications such as chatbots, customer support forum, customer reviews etc. So you have to train a machine learning model that can identify the emotion of a text by presenting the most relevant emoji according to the input text.

2. *Use Case:* Customer Personality Analysis is a detailed analysis of a company's ideal customers. It helps a business to better understand its customers and makes it easier for them to modify products according to the specific needs, behaviours and concerns of different types of customers.

   You have to do an analysis that should help a business to modify its product based on its target customers from different types of customer segments. For example, instead of spending money to market a new product to every customer in the company's database, a company can analyze which customer segment is most likely to buy the product and then market the product only on that particular segment.

(Note: It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXT BOOK:

1. Cathy O'Neil and Rachel Schutt, *Doing Data Science*, O'Reilly, 2015

REFERENCE BOOKS:

1. David Dietrich, Barry Heller, Beibei Yang, *Data Science and Big Data Analytics*, EMC 2013.
2. Davy cielen, *Introducing Data Science*, Manning Publications, 2022.
3. Chirag Shah, *A Hands-on Introduction to Data Science*, Cambridge University Press, 2020

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=JL_grPUnXzY&list=PLeo1K3hjS3us_ELKYSj_Fth2tIEkdKXvV
2. https://www.youtube.com/watch?v=-ETQ97mXXF0

WEB RESOURCES:

1. https://swayam.gov.in/nd1_noc19_cs60/preview

2. https://towardsdatascience.com/
3. https://www.w3schools.com/datascience/
4. https://github.com/jakevdp/PythonDataScienceHandbook
5. https://www.kaggle.com

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22AI101704	**INTRODUCTION TO MACHINE LEARNING**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Introduction to machine learning, Bayesian concept learning, Supervised learning, Unsupervised learning, Artificial neural networks.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Analyze the process of machine learning modeling and evaluation to automatically infer a general description for a given learning problem.

CO2 Analyze the underlying mathematical models within machine learning algorithms and learning tasks.

CO3 Design and implement machine learning solutions for classification, regression, and clustering problems.

CO4 Design and implement efficient neural architectures to model patterns for a given learning problem.

CO5 Develop intelligent solutions to solve societal problems related to computer vision, information security, healthcare and other areas.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	3	3	3	3	-	-	-	-	-	-	-
CO4	3	3	3	1	-	-	-	-	-	-	-	-
CO5	1	3	3	3	3	3	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION TO MACHINE LEARNING   *(10 Periods)*
Machine Learning: Human learning, Types of human learning, Machine learning, Types of machine learning, Applications of machine learning, Issues in machine learning, Machine learning activities, Types of data, Selecting a model, Training a model, Model representation and interpretability, Evaluating performance of a model, Improving performance of a model.

Module 2:   BAYESIAN CONCEPT LEARNING   *(07 Periods)*
Introduction, Importance, Bayes' theorem, Bayes optimal classifier, Naïve Bayes classifier, Applications of Bayes classifier.

Module 3:   SUPERVISED LEARNING   *(10 Periods)*
Classification: Classification model, Classification learning steps, K-Nearest Neighbor, Decision Tree, Support vector machines.
Regression: Introduction, Simple linear regression, Improving accuracy of the linear regression model, Multiple linear regression, Assumptions and problems in regression analysis.

Module 4:   UNSUPERVISED LEARNING   *(09 Periods)*
Introduction, Unsupervised vs supervised learning, Applications of unsupervised learning, Clustering as a machine learning task, Types of clustering techniques, Partitioning methods, K-Medoids, Hierarchical clustering, DBSCAN.

Module 5:   ARTIFICIAL NEURAL NETWORKS   *(09 Periods)*
Artificial neuron, Types of activation functions, Early implementations of ANN, Architectures of neural network, Learning process in ANN, Backpropagation.

Total Periods: 45

EXPERIENTIAL LEARNING

1.   Use Naïve Bayes classifier to solve the credit card fraud detection problem.
2.   Build a neural network that will read the image of a digit and correctly identify the number.

(Note: It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXT BOOKS:

1.   Tom M. Mitchell, *Machine Learning*, McGraw Hill, 1997.

2.   Saikat Dutt, Subramanian Chandramouli, Amit kumar das, *Machine Learning*, Pearson, 2019.

REFERENCE BOOKS:

1.   Manaranjan Pradhan, U Dinesh Kumar, *Machine Learning Using Python*, Packt Publishing, 2019.
2.   Aurelien Geron, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems*, O'Reilly, 2nd Edition, 2019.
3.   Ethem Alpaydin, *Introduction to Machine Learning*, MIT Press, 4th Edition, 2020.
4.   Shai Shalev Shwartz, Shai Ben David, *Understanding Machine Learning: From Theory to Algorithms*, Cambridge University Press, 2014.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/106106202/

2. https://www.coursera.org/learn/machine-learning

3. https://onlinecourses.nptel.ac.in/noc23_cs18/preview

4. https://onlinecourses.nptel.ac.in/noc23_cs87/preview
5. https://onlinecourses.nptel.ac.in/noc23_ee87/preview

6. https://www.coursera.org/learn/ntumlone-algorithmicfoundations

7. https://www.coursera.org/specializations/machine-learning-introduction

8. http://ndl.iitkgp.ac.in/document/YkxlRXFvZXJrTDBkVzVVZi9ESjl6eXpRZkxRc2lhO WhlVXBhUVVWaXZlNDNyZUVldU9LdlYvd20wbkQ4MC92UQ

9. https://www.coursera.org/learn/unsupervised-learning-recommenders-reinforcement-learning

WEB RESOURCES:

1. https://www.ibm.com/topics/machine-learning

2. https://www.simplilearn.com/tutorials/machine-learning-tutorial/what-is-machine-learning

3. https://www.w3schools.com/python/python_ml_getting_started.asp

4. https://developers.google.com/machine-learning/crash-course

5. https://www.greenteapress.com/thinkstats/
6. https://info.deeplearning.ai/machine-learning-yearning-book
7. https://www.kaggle.com/code/kanncaa1/machine-learning-tutorial-for-beginners
8. https://machinelearningmastery.com/machine-learning-in-python-step-by-step/

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CS101701	**INTRODUCTION TO PYTHON PROGRAMMING**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course is aimed at offering the fundamental concepts of Python scripting language to the students. It starts with the basics of Python programming and deals with lists, dictionaries, functions, exceptions and files. The objective of this course is to enable the students to develop the applications using the concepts of Python.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the basic terminology used in computer programming to write, compile and debug programs in Python programming language.

CO2. Use appropriate data type for handling user data and write optimized programs using the functions, and statements.

CO3. Manage the exceptions raised during the program execution and avoid abrupt termination of the program execution.

CO4. Process files and solve real world problems using classes and objects in the Python programming environment.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	2	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	2	-
CO4	2	3	3	-	-	-	-	2	-	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**2**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   DATA TYPES AND INPUT/OUTPUT   *(09 Periods)*
Internal working of Python, Python character set, Tokens, Python Core Data Types (list, set, tuple, and dctionary), The print () function, Assignment of values to variables, The input() function, The eval() function.

Module 2:   OPERATORS AND CONTROL STATEMENTS   *(09 Periods)*
Operators- Arithmetic Operators, Operator precedence and Associativity, Bitwise operator, The compound assignment operator; Decision statements- Boolean operators, Boolean Expressions and Relational operators, Decision making statements; Loop Control Statements-while loop, range() function, for loop; break statement, continue statement.

Module 3: FUNCTIONS AND LISTS *(09 Periods)*

Functions- Syntax and basics of a function, Use of a function, Parameters and arguments in a function, The local and global scope of a variable, The return statement, Recursive functions, The lambda function; Lists-Creating Lists, Accessing the elements of a List, List slicing, Python in-built functions for lists, List Comprehension, List Methods, Passing list to a function, Returning a list to function.

Module 4: TUPLES, SETS AND DICTIONARIES *(09 Periods)*

Tuples - Creating tuples, tuple() function, Inbuilt functions for tuples, Indexing and Slicing, Operations on tuples, Passing variable length arguments to tuples, Sort tuples, Traverse tuplesfrom a list, The zip()function, The Inverse zip(*) function; Sets - Creating sets, The set in and not in operator, The Python Set Class, Set operations; Dictionaries -Basics of Dictionaries, Creating a Dictionary, Adding and replacing values, Retrieving values, Formatting dictionaries, Deleting items, Comparing two dictionaries, Methods of dictionary class, Traversing dictionaries, Nested dictionaries, Traversing nested dictionaries.

Module 5: V FILES *(09 Periods)*

File Handling-Opening a file, Writing Text, Closing files, Writing numbers to a file, Reading Text, Reading numbers from a file, Appending data, seek() function.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Calculator: Create a basic calculator program that can perform addition, subtraction, multiplication, and division operations. You can enhance it by adding more functionality, such as handling decimal numbers or including additional mathematical operations.

2. Develop recursive functions to solve problems that involve self-referential definitions.

3. Develop program to create dictionaries, add, retrieve and delete items from dictionaries.

4. Word Counter: Design a program that counts the number of words, characters, or lines in a given text file. You can also include additional features like finding the most common words or displaying statistics about the text.

5. Tic-Tac-Toe: Implement a two-player tic-tac-toe game where users take turns marking Xs and Os on a 3x3 grid. Determine the winner or detect a tie by checking the board after each move.

6. Dice Rolling Simulator: Create a program that simulates rolling dice. Allow the user to specify the number of dice to roll and display the results. You can also add features like keeping track of the roll history or calculating the probability of certain outcomes.

(Note: It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXTBOOKS:
1. Ashok Namdev kamthane and Amit Ashok Kamthane, *Programming and Problem solving with PYTHON*, McGraw Hill Education, 1st Edition, 2016.

REFERENCE BOOKS:
1. Allen Downey, *Think Python*, Green Tea Press, 1st Edition, 2016.
2. W.J. Chun, *Core Python Programming*, Prentice Hall, 3rd Edition, 2013.
3. Kenneth A. Lambert, *Fundamentals of Python*, Cengage, 2nd Edition, 2015.

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc19_cs41/preview

2. https://www.coursera.org/specializations/python

3. https://www.coursera.org/learn/python-for-applied-data-science-ai

4. https://www.youtube.com/watch?v=WGJJIrtnfpk
5. https://www.youtube.com/watch?v=_uQrJ0TkZlc
6. https://www.udemy.com/topic/python/
7. https://freevideolectures.com/course/2512/python-programming

WEB RESOURCES:

1. https://www.w3schools.com/python/
2. https://www.programiz.com/python-programming
3. https://www.geeksforgeeks.org/python-programming-language/
4. https://www.javatpoint.com/python-lists
5. https://www.learnpython.org/

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CB101704	**INTRODUCTION TO INTERNET OF THINGS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course is emphasize on the Architecture of IoT and Summarize the roles of various organizations for IoT, To Develop simple applications using Arduino and Rasberry, Test for errors in the application, Predict the market value, Experiment with embedded boards for creating IoT prototypes, To understand the domain specific IoTs and IoT system management.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1 Understand the fundamental concepts of IoT and physical computing.
CO2 Demonstrate knowledge on variety of embedded boards and IoT Platforms
CO3 Understand the communication protocols in IoT communications.
CO4 Demonstrate knowledge on Domain specific IoT applications.
CO5 Understand the IoT System management and network management protocols.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-
CO5	3	2	2				-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT

Module 1: OVERVIEW OF IOT *(09 Periods)*
The Internet of Things: An Overview, The Flavour of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?
Design Principles for Connected Devices: Calm and Ambient Technology, Privacy, Web Thinking for Connected Devices, Affordances.
Prototyping: Sketching, Familiarity, Costs Vs Ease of Prototyping, Prototypes and Production, Open source Vs Close source, Tapping into the community.

Module 2: EMBEDDED DEVICES: *(09 Periods)*
Electronics, Embedded Computing Basics, Arduino, Raspberry Pi, Mobile phones and tablets, Plug Computing: Always-on Internet of Things

Module 3   COMMUNICATION IN THE IOT: *(09 Periods)*
Internet Communications: An Overview, IP Addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols
Prototyping Online Components: Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols Protocol

Module 4   DOMAIN SPECIFIC IOTS   *(09 Periods)*
Introduction: Home automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle

Module 5   IOT AND M2M   *(09 Periods)*
Introduction- M2M, Difference between IoT and M2M, SDN and NFV for IoT
IoT System Management with NETCONF-YANG: Need for IoT Systems Management, Simple network management protocol(SNMP), Network operator requirements, NETCONF,YANG

                                                        Total Periods: 45

EXPERIENTIAL LEARNING
1.   (a) Design and Simulate LED 7-Segment Display interfacing with Arduino.
    (b) Design and Simulate Servo motor interfacing with Arduino.
2. (a) Design and Simulate ultrasonic sensor and LCD interfacing with Arduino.
    (b) Design and Simulate Flame Sensor interfacing with Arduino.
(Note: It's an indicative one. The Course Instructor may change the activities and the same shall be reflected in Course Handout)

RESOURCES

TEXT BOOKS:
1. Adrian McEwen, Hakim Cassimally, *Designing the Internet of Things*, Wiley Publications, 2012
2. Arshdeep Bahga, Vijay Madisetti, *Internet of Things: A Hands-On Approach*, Universities Press, 2014.

REFERENCE BOOKS:
1. Pethuru Raj, Anupama C. Raman, *The Internet of Things, Enabling technologies and use cases*, CRC Press.

VIDEO LECTURES:
1. https://www.digimat.in/nptel/courses/video/106105166/L01.html
2. https://www.youtube.com/watch?v=oBZnySDgst8

WEB RESOURCES:
1.   https://www.arduino
2.   https://www.raspberrypi.org/

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22ME101703	**MANAGEMENT SCIENCE**	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION:
Concepts of Management; Concepts Related to ethics and social responsibility; Human Resource Management; Operations Management; Statistical Process Control; Inventory Management; Marketing; Project Management; Project Crashing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1 Demonstrate the concepts of management, its functions and processes used in optimum resource utilization within the context of ethics and social responsibility.
CO2 Apply the concepts of HRM for selection and management of human resources.
CO3 Analyze different operations management problems using quality management tools to produce effective, efficient and adoptable products/services
CO4 Identify different marketing strategies to maximize enterprise profitability and customer satisfaction within the realistic constraints
CO5 Develop network models in time-cost trade-off for effective project management.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	1	1	1	1	-	-	1	-
CO2	3	2	1	-	1	-	-	-	-	-	1	-
CO3	3	3	1	1	1	-	-	-	-	-	1	-
CO4	3	2	1	-	1	1	-	-	-	-	1	-
CO5	3	3	3	1	1	1	-	-	-	-	2	-
Course Correlation Mapping	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**-**	**1**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   MANAGERIAL FUNCTION AND PROCESS *(10 Periods)*
Concept and foundations of management, Evolution of management thought; Managerial functions – Planning, Organizing, Directing and Controlling; Decision-making; Role of manager, managerial skills; Managing in a global environment, Flexible systems management; Social responsibility and managerial ethics; Process and customer orientation; Managerial processes on direct and indirect value chain.

Module 2:   HUMAN RESOURCE MANAGEMENT *(08 Periods)*
Human Resource challenges; Human Resource Management functions; Human Resource Planning; Job analysis; Job evaluation, Recruitment and selection; Training and Development; Promotion and transfer; Performance management; Compensation management and benefits; Employee morale and productivity; Human Resource Information System.

Module 3:   OPERATIONS MANAGEMENT   *(10 Periods)*

Fundamentals of Operations Management, Services as a part of operations management; Facilities location and layout; Line balancing; Quality management – Statistical Process Control, Total Quality Management, Six sigma; Role and importance of materials management, Value analysis, Make or Buy decision, Inventory control, Materials Requirement Planning, Enterprise Resource Planning, Supply Chain Management.

Module 4:   MARKETING MANAGEMENT   *(08 Periods)*

Concept, evolution and scope; Marketing strategy formulation and components of marketing plan; Segmenting and targeting the market; Positioning and differentiating the market offering, Analyzing competition; Product strategy; Pricing strategies; Designing and managing marketing channels; Integrated marketing communications.

Module 5:   PROJECT MANAGEMENT   *(09 Periods)*

Project management concepts; Project planning – Work Breakdown Structure, Gantt chart; Project scheduling – Critical Path Method, Program Evaluation and Review Technique, Crashing the project for time-cost trade off; Resource Levelling.

Total Periods: 45

EXPERIENTIAL LEARNING

1.   Find the social responsibilities in the context of management theoretically and practically in an organization? Explain them by taking a real case study in any organization (preferably in your organization).
2.   Gaining market share should be one of management's primary goals because of its effect on operations and profitability. Comment. What Strategies Do Companies Employ to Increase Market Share?
3.   A Gantt chart is a visualization that helps in scheduling, managing, and monitoring specific tasks and resources in a project. Prepare a gantt chart for Online food ordering system.

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

RESOURCES

TEXT BOOKS:

1.   MartandT. Telsang, *Industrial Engineering and Production Management,* S. Chand, 3rd Edition, 2018.
2.   Koontz and Weihrich, *Essentials of Management*, TMH, New Delhi, 11th Edition, 2020.

REFERENCE BOOKS:

1.   O.P. Khanna, *Industrial Engineering and Management,* Dhanpat Rai and Sons, 2018.
2.   N.D. Vohra, *Quantitative Techniques in Management,* TMH, New Delhi, 5th Edition, 2014.
3.   L.M. Prasad, *Principles and practice of Management,* S. Chand and Sons, 2019.

VIDEO LECTURES:

1.   https://archive.nptel.ac.in/courses/122/106/122106032/
2.   https://www.digimat.in/nptel/courses/video/122102007/L01.html

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22ME101704	**MANAGING INNOVATION AND ENTERPRENEURSHIP**	3	-	-	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION:
Evolution of entrepreneurship from economic theory Managerial and entrepreneurial competencies; Concepts of Shifting Composition of the Economy Purposeful Innovation & Sources of Innovative Opportunity; The Innovation Process; Innovative Strategies; Entrepreneurial Motivation; Entrepreneurs versus inventors; Ethics and International Entrepreneurship; Strategic Issues in International Entrepreneurship; Problem solving Innovation and Diversification

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate the principles of innovation process for establishing Industrial ventures.
CO2. Identify and analyze the gaps in an organization for innovation in the context of developed economies
CO3. Develop a comprehensive and well-planned business structure for a new venture.
CO4. Demonstrate knowledge on intellectual property rights, patents, trademarks, copyrights, trade secrets and commercialization of intellectual property.
CO5. Apply ethics in constructive innovation framework and problem solving.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	1	-	1	1	1	1	-	-	1	-
CO2	3	2	1	-	1	-	-	-	-	-	1	-
CO3	3	3	1	1	1	-	-	-	-	-	1	-
CO4	3	2	1	1	1	1	-	-	-	-	1	-
CO5	3	3	3	1	1	1	-	-	-	-	2	-
Course Correlation Mapping	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	-	-	**1**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   CREATIVITY AND INNOVATION   *(09 Periods)*
Introduction, Levels of innovation, Purposeful innovation and the sources of innovative opportunity, The innovation process, Innovative strategies, Strategies that aim at introducing and innovation, Dynamics of ideation and creativity – Inbound, Outbound; Context and process of new product development, Theories of outsourcing.

Module 2:   PARADIGMS OF INNOVATION   *(09 Periods)*
Systems approach to innovation, Innovation in the context of developed economies and Emerging economies, Examining reverse innovation and its application, Performance gap, Infrastructure gap, Sustainability gap, Regulatory gap, Preference gap, organizational factors effecting innovation at firm level.

Module 3: SOUCES OF FINANCE AND VENTURE CAPITAL   *(09 Periods)*

Importance of finance, Comparison of venture capital with conventional development capital, Strategies of venture funding, Investment phases, Investment process, Advantages and disadvantages of venture capital, Venture capital developments in India.

Module 4: INTELLECTUAL PROPERTY INNOVATION AND   *(09 Periods)*
ENTREPRENEURSHIP

Introduction to Entrepreneurship, Evolution of entrepreneurship from economic theory, Managerial and entrepreneurial competencies, Entrepreneurial growth and development, Concepts, Ethics and Nature of International Entrepreneurship, Intellectual property – forms of IP, Patents, Trademarks, Design registration, Copy rights, Geographical indications, Patent process in India.

Module 5: OPEN INNOVATION FRAME WORK & PROBLEM SOLVING   *(09 Periods)*

Concept of open innovation approach, Difference between open innovations and Cloud innovation approaches, Limitations and Opportunities of open innovation frame work, Global context of strategic alliance, Role of strategic alliance, Problem Identification and Problem Solving, Innovation and Diversification

Total Periods:45

EXPERIENTIAL LEARNING

1.   Identify the Innovative Marketing Strategies for Startups

2.   Identify the Coca-cola Company Intellectual Property Rights

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

CASE STUDIES/ARTICELS:

Contemporary relevant case studies/ Articles will be provided by the course instructor at the beginning.

1.   Tesla Inc.: Disrupting the Automobile Industry
        This case study examines how Tesla Inc. disrupted the traditional automobile industry through its innovative electric vehicles and sustainable energy solutions. It discusses the sources of innovative opportunity that Tesla leverages, the ideation and creativity dynamics involved in new product development, and the strategies that the company uses to introduce and market its innovations.

2.   Google Inc.: Innovation in Developed Economies
        This case study explores how Google Inc. became a global leader in the technology industry through its innovative search engine, advertising, and cloud computing solutions. It highlights the performance gap that Google addressed, the regulatory and sustainability gaps that it leveraged, and the impact of its innovation strategies on the company's growth and profitability.

3.   Flipkart: From Startup to Unicorn
        This case study examines how Flipkart, an Indian e-commerce company, secured venture capital funding to become one of the largest online marketplaces in India. It discusses the importance of finance in entrepreneurship, the advantages and disadvantages of venture capital, and the strategies that Flipkart used to attract venture funding.

4. Patanjali Ayurved: Building a Brand through Intellectual Property
This case study explores how Patanjali Ayurved, an Indian consumer goods company, built a strong brand through its intellectual property strategies. It discusses the forms of IP that Patanjali leverages, the patent process in India, and the impact of IP on the company's growth and profitability.

5. Procter & Gamble: Innovation through Open Innovation
This case study analyzes how Procter & Gamble, a global consumer goods company, leveraged open innovation to achieve unprecedented success in product development and marketing. It discusses the difference between open and cloud innovation approaches, the limitations and opportunities of open innovation, and the role of strategic alliances in global innovation.

RESOURCES

TEXT BOOKS:

1. Vinnie Jauhari, Sudhanshu Bhushan, *Innovation Management*, Oxford University Press, 1st Edition, 2014.
2. Drucker, P.F., *Innovation and Entrepreneurship*, Taylor & Francis, 2nd Edition, 2007.

REFERENCE BOOKS:

1. Robert D Hisrich, Claudine Kearney, *Managing Innovation and Entrepreneurship,* Sage Publications, 1st Edition, 2014.
2. V.K. Narayanan, *Managing Technology and Innovation for Competitive Advantage,* Pearson India, 1st Edition, 2002.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=wWsl48VLfVY
2. https://www.youtube.com/watch?v=dDpQ9ALKX0U
3. https://www.youtube.com/watch?v=Eu_hkxkJGTg

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22ME101705	MATERIAL SCIENCE	3	-	-	-	3

Pre-Requisite –

Anti-Requisite –

Co-Requisite –

COURSE DESCRIPTION: Materials Structure and Constitution of Alloys; Heat treatment of steels; Properties of ferrous materials and its alloys; Properties of non-ferrous materials and its alloys; Properties and applications of Ceramics, Polymers and Composite materials.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Ability to understand and apply the principles of materials science to analyze and design materials for specific applications.

CO2. Analyze the properties of materials and enhance the same through heat-treatment processes.

CO3. Demonstrate the knowledge of ferrous and Non-ferrous materials and its alloys for engineering applications.

CO4. Understand the relationship between materials properties and structure at the atomic and molecular level.

CO5. Demonstrate the knowledge of Ceramics, Polymers, and Composite materials for suitable engineering applications.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	-	-	-	-	-	-	1	-	-
CO2	3	3	1	-	-	-	-	-	-	1	-	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-
CO5	3	1	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	2	1	-	-	-	-	-	-	1	-	-

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   MATERIALS STRUCTURE AND CONSTITUTION OF ALLOYS   *(09 Periods)*

Materials Structure: Space lattice, Unit cells and Metallic crystal structures (SC, BCC, FCC and HCP), Crystal defects: Point, Line, Interstitial and Volume, Primary and secondary bonding in materials.

Constitution of Alloys: Necessity of Alloying, Gibbs's phase and Hume Rothery rule, Iron Iron-carbide diagram and its microstructural aspects.

Module 2:   HEAT TREATMENT OF STEELS   *(09 Periods)*

Annealing, Normalizing, Tempering, Carburization and Hardening- Austempering, Martempering, Carburizing, Nitriding, Cyaniding, Carbo-Nitriding, Flame and Induction Hardening, Vacuum and Plasma Hardening, Time-Temperature-Transformation Diagrams and Continuous Cooling Transformation Diagrams.

Module 3:   FERROUS MATERIALS AND ALLOYS   *(09 Periods)*
Steels: Structure, properties, classifications and applications of plain steels, Specifications of steels, Structure, properties, classifications and applications of low alloy steels, Hadfield manganese steels, Stainless steel and Tool steels.
Cast iron: Structure, properties and applications of Gray cast iron, White cast iron, Malleable cast iron, Nodular cast iron and Alloy cast iron.

Module 4:   NON-FERROUS MATERIALS AND ALLOYS   *(09 Periods)*
Structure, properties and applications of Copper and its alloys, Aluminium and its alloys, Titanium and its alloys, Nickel and its alloys, Magnesium and its alloys, Refractory and Precious metals.

Module 5:   CERAMICS, POLYMERS AND COMPOSITES MATERIALS   *(09 Periods)*
Ceramics: Classifications, Properties and Applications, Glass-ceramics, Polymers: Classification, Properties and Applications, Polymerization Reaction,
Composites: Classifications, Properties and Applications of Polymer matrix composites, Ceramic matrix composites, Metal matrix composites and Nanocomposites.
                                                                 Total Periods: 45

EXPERIENTIAL LEARNING
1. Laboratory experiments allow students to apply theoretical concepts and learn how to conduct experiments safely and effectively. Some examples of laboratory experiments include mechanical testing of materials, heat treatment of metals, and microscopy analysis of materials.
2. Materials characterization techniques such as X-ray diffraction, scanning electron microscopy, and transmission electron microscopy can provide valuable insights into the structure and properties of materials. Students can gain hands-on experience with these techniques by conducting experiments and analyzing the results.

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

RESOURCES
TEXT BOOKS:

1. V. Raghavan, *Materials Science & Engineering*, Prentice Hall of India, 5th edition, 2004.
2. R. Balasubramaniam, Callister's, *Materials Science & Engineering*, John Wiley and sons, 2nd edition, 2014.

REFERENCE BOOKS:

1. Sidney H. Avner, *Introduction to Physical Metallurgy*, Tata McGraw Hill, 2nd edition,1997.

2. George E Dieter, *Mechanical Metallurgy*, Tata McGraw Hill, 3rd edition, 2013.

3. Kodigre V D, *Material Science and Metallurgy*, Everest Publishing House, 31st edition, 2011.

VIDEO LECTURES:
1. https://ocw.mit.edu/courses/materials-science-and-engineering/3-012-fundamentals-of-materials-science-fall-2005/lecture-notes/
2. https://nptel.ac.in/courses/116/104/116104045/

3. https://www.youtube.com/watch?v=tsX-VYvkiJ8&list=PLJV_OG0NLkV8VRNFk-0AyDZz1pZym6V8j
4. https://www.khanacademy.org/science/materials-science

WEB RESOURCES:

1. https://www.doitpoms.ac.uk/tlplib/teachers.php

2. https://www.springer.com/journal/10853

3. http://dmse.mit.edu/
4. http://dmse.mit.edu/

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22LG101702	**PERSONALITY DEVELOPMENT**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course gives awareness to students about the various dynamics of personality development.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge in Self-Management and Planning Career

CO2. Analyze the functional knowledge in attitudes and thinking strategies

CO3. Learn and apply soft skills for professional success.

CO4. Function effectively as an individual and as a member in diverse teams

CO5. Communicate effectively in public speaking in formal and informal situations.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-	-	2	-	-
CO4	1	1	-	-	-	-	-	-	3	3	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-
Course Correlation Mapping	**2**	**2**	**3**	**-**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**

Correlation Levels: *3: High;*   *2: Medium;*   *1: Low*

COURSE CONTENT

Module 1:   SELF-ESTEEM & SELF-IMPROVEMENT   *(09 Periods)*

Know Yourself – Accept Yourself; Self-Improvement: Plan to Improve - Actively Working to Improve Yourself- Exercises- case studies

Module 2:   DEVELOPING POSITIVE ATTITUDES   *(09 Periods)*

How Attitudes Develop – Attitudes are Catching – Improve Your Attitudes – Exercises- case studies

Module 3   SELF-MOTIVATION & SELF-MANAGEMENT   *(09 Periods)*

Show Initiative – Be Responsible Self-Management; Efficient Work Habits – Stress Management – Employers Want People Who can Think – Thinking Strategies- Exercises- case studies

Module 4   GETTING ALONG WITH THE SUPERVISOR   *(09 Periods)*

Know your Supervisor – Communicating with your Supervisor – Special Communication with your Supervisor – What Should you Expect of Your Supervisor? – What your Supervisor expects of you - Moving Ahead Getting Along with your Supervisor- Exercises- case studies

Module 5   WORKPLACE SUCCESS   *(09 Periods)*

First Day on the Job – Keeping Your Job – Planning Your Career – Moving Ahead- Exercises- case studies

Total Periods: 45

EXPERIENTIAL LEARNING

1.   List out the self-improvements in you on the charts and explain in detail.

2.   Discuss different famous personalities and their attitudes.

3.   Describe different personalities with respect to self-motivation and self-management.

4.   Imagine you are a supervisor and illustrate different special communications.

5.   Assume and Interpret different experiences on the first day of your job.

(Note: It's an indicative one. Course instructor may change the activities and the same shall be reflected in course handout)

RESOURCES

TEXTBOOK:

1.   Harold R. Wallace and L. Ann Masters, *Personal Development for Life and Work*, Cengage Learning, Delhi, 10th edition Indian Reprint, 2011. (6th Indian Reprint 2015)

2.   Barun K. Mitra, *Personality Development and Soft Skills,* Oxford University Press, 2011.

REFERENCE BOOKS:

1.   K. Alex, *Soft Skills*, S. Chand & Company Ltd, New Delhi, 2nd Revised Edition, 2011.
2.   Stephen P. Robbins and Timothy A. Judge*, Organizational Behaviour*, Prentice Hall, Delhi, 16th edition, 2014

VIDEO LECTURES:

1.   https://www.youtube.com/watch?v=6Y5VWBLi1es
2.   https://www.youtube.com/watch?v=H9qA3inVMrA

WEB RESOURCES:

1.   https://www.universalclass.com/.../the-process-of-perso...
2.   https://www.ncbi.nlm.nih.gov/pubmed/25545842
3.   https://www.youtube.com/watch?v=Tuw8hxrFBH8

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CE101703	**PLANNING FOR SUSTAINABLE DEVELOPMENT**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on sustainable development, environmental impact, sustainable policies, governance, theories and strategies, media and education for sustainability.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Compare sustainable development theories in national and global context to protect the society and environment.

CO2 Analyze the unforeseen environmental impacts on sustainable development to protect the society and environment.

CO3 Analyze policies and governance for sustainable development considering ethics, economics, society and environment.

CO4 Analyze systems and strategies for sustainable development using appropriate tools and techniques considering ethics, economics, society and environment.

CO5 Analyze the role of media and education in sustainable development using appropriate tools and techniques considering ethics, society and environment besides communicating effectively.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	-	-	-	2	2	-	-	-	-	-
CO2	3	3	-	-	-	2	2	-	-	-	-	1
CO3	3	3	-	-	-	2	2	2	-	-	1	-
CO4	3	3	-	-	2	2	2	2	-	-	1	-
CO5	3	3	-	-	2	2	2	2	-	1	-	-
Course Correlation Mapping	**3**	**3**	**-**	**-**	**2**	**2**	**2**	**2**	**-**	**1**	**1**	**1**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1: SUSTAINABLE DEVELOPMENT *(09 Periods)*

Definition and concepts of sustainable development, Capitalization of sustainability- National and global context; Sustainable development goals, Emergence and evolution of sustainability and sustainable development, Theories of sustainability, Case studies.

Module 2: ENVIRONMENTAL IMPACT *(09 Periods)*

Climate change – Science, Knowledge and sustainability; Unforeseen environmental impacts on development, Challenges of sustainable development, Centrality of resources in sustainable development, Case studies.

Module 3: SUSTAINABLE POLICIES AND GOVERNANCE *(09 Periods)*

Governance - Democracy and Eco–welfare; Global civil society and world civil politics, Civic environmentalism, Policy responses to sustainable development, Economics of sustainability, Social responsibility in sustainability, National action, ISO 14001: Environmental management system.

Module 4: SUSTAINABLE SYSTEMS AND STRATAGIES *(09 Periods)*

Need for system innovation, Transition and co–evolution, Theories and methods for sustainable development, Strategies for eco–innovation, Ecological foot print analysis, Socio ecological indicators – Eco labels; Policy programmes for system innovation, Case studies.

Module 5: MEDIA AND EDUCATION FOR SUSTAINABILITY *(09 Periods)*

Role of emerging media, Remarkable design and communication art, Activism and the public interest, Education for sustainability, Participation in decision making, Critical thinking and reflection, Case studies.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Submit a study report on the importance and implementation of United Nationals sustainable goals 17 among all the ratified nations.

2. Submit a study report on any one case study that the challenges being faced during the sustainable development goals implementation.

3. Submit a study report on the social responsibility in implementation of sustainability concept.

4. Prepare and submit a report on any two case studies that how the eco labels put on their products shall make the consumers feel satisfaction over the sustainable development.

5. Submit a report on the communication art and activism through media which makes the public interest that helps to contribute towards sustainable development.

RESOURCES

TEXT BOOKS:

1. John Blewitt, *Understanding Sustainable Development*, Earth Scan Publications Ltd., 2nd Edition, 2008.

2. Jennifer A. Elliot, *An Introduction to Sustainable Development*, Earth Scan Publications Ltd., 4th Edition, 2006.

REFERENCE BOOKS:

1. Peter Rogers, Kazi F Jalal and John A Boyd, *An Introduction to Sustainable Development*, Earth Scan Publications Ltd., 2006.
2. Simon Dresner, *The Principles of Sustainability*, Earth Scan Publications Ltd., 2nd Edition, 2008.
3. Peter Bartelmus, *Environment Growth and Development: The Concepts and Strategies of Sustainability*, Routledge, 3rd Edition, 2003.
4. Gabriel Moser, Enric Pol, Yvonne Bernard, MiriliaBonnes, Jose Antonio Corraliza and Maria Vittoria Giuliani, *People Places and Sustainability*, Hogrefe& Huber Publishers, 2nd Edition, 2003.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=a5i9RVyhBtc
2. https://www.youtube.com/watch?v=fH_iIVPTujE
3. https://www.youtube.com/watch?v=c2eNrFK5M8I
4. https://www.youtube.com/watch?v=qfOgdj4Okdw
5. https://www.youtube.com/watch?v=_qLqLJq2954

WEB RESOURCES:

1. https://civil.gecgudlavalleru.ac.in/images/admin/pdf/1594706742_III-II-OE-Planning-for-Sustainable-Development.pdf
2. https://www.academia.edu/26950843/Sustainable_Development_in_Practice_Case_Studies_for_Engineers_and_Scientists
3. https://www.academia.edu/24286208/The_Role_of_the_Professional_Engineer_and_Scientist_in_Sustainable_Development
4. https://byjusexamprep.com/liveData/f/2022/8/sustainable_development_goals_upsc_notes_43.pdf
5. https://sdgs.un.org/sites/default/files/2020-10/course%201_Peter_Tarr%20%20-%20%20Compatibility%20Mode.pdf

Course Code	Course Title	L	T	P	S	C
22EC101705	**PRINCIPLES OF COMMUNICATION ENGINEERING**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: Fundamentals of Communications; Analog and digital - modulation and Demodulation Techniques; Information theory and coding.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyze different Analog and Digital Modulation Schemes to improve bandwidth and power efficiency.

CO2. Analyze Pulse Analog modulation Schemes.

CO3. Understand the concepts of Baseband & Passband Digital Transmission.

CO4. Analyze various error detection and correction codes for reliable transmission.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	1	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**2**	**1**	**-**	**-**	**-**	-	-	-	-	-

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   ANALOG MODULATION   *(13 Periods)*

Block diagram of Electrical Communication System, Types of Communications, Need for Modulation, Types of Amplitude Modulation- AM, DSBSC, SSBSC, Power and BW requirements, Generation of AM, DSBSC, SSBSC. Detection of AM - Diode detector, Product demodulation for DSBSC & SSBSC. Frequency & Phase Modulations.

Module 2:   PULSE MODULATION   *(07 Periods)*

Elements & Advantages of Digital communication systems, PAM, Regeneration of Base band Signal, PWM and PPM, Time Division Multiplexing, Frequency Division Multiplexing.

Module 3: BASE BAND DIGITAL TRANSMISSION   *(07 Periods)*

Pulse Code Modulation- Advantages, Block diagram of PCM, Quantization, effect of Quantization, Quantization error. DM, ADM and Comparison of PCM,DM & ADM.

Module 4: PASS BAND DIGITAL TRANSMISSION   *(10 Periods)*

Digital Binary Schemes-ASK, FSK, PSK, DPSK, QPSK, Modulation and Demodulation - Coherent and Non-coherent techniques.


Module 5: INFORMATION THEORY AND CODING   *(08 Periods)*

Concept of Information, Entropy and Rate of Information, Coding efficiency, Shannon-Fano and Huffman Coding.

Error Correction and Detection Codes- Linear Block Codes, Cyclic Codes, Convolution Codes.

Total Periods: 45

EXPERIENTIAL LEARNING

1   Suppose that a non-linear device is available for which the output current i0 and the input voltage vi are related by: $i_0(t) = a_1 v_i(t) + a_3 v_3 i(t)$ where a_1 and a_3 are constants. Explain how this device may be used to provide(a) a product modulator (b) an amplitude modulator.

2   A voice signal occupying the frequency band 0.3 - 3.4 KHz is to be modulated onto a carrier wave of frequency 11.6 MHz. High pass filters such as the one shown below are available. Design a system to generate the USB wave using DSB modulators and these filters.
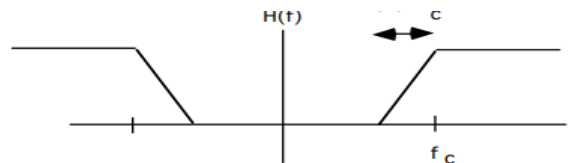
3   In a binary PCM system, the output signal to-quantizing noise ratio is to be held to a minimum of 40 dB. Determine the number of required levels, and find the corresponding output signal to quantizing-noise ratio.

4   A bipolar binary signal $S_l(t)$ is a +1V or -1V pulse during the interval (O, T). Additive white noise with power spectral density $\eta/2 = 10^{-5}$ W /kHz. W/Hz is added to the signal. Determine the maximum bit rate that can be sent with a bit error probability of $P_e \leq 10^{-7}$

5   A compact disc (CD) recording system samples each of two stereo signals with a 16-bit analog-to digital converter (ADC) at 44.1 kb/s.
   a) Determine the output signal-to-quantizing-noise ratio for a full-scale sinusoid.
   b) The bit Stream of digitized data is augmented by the addition of error-correcting bits, clock extraction bits, and display and control bit fields. These additional bits represent 100 percent overhead. Determine the output bit rate of the CD recording system.
   c) The CD can record an hour's worth of music. Determine the number of bits recorded on a CD. For a comparison, a high-grade collegiate dictionary may contain 1500 pages, 2 columns per page, 100 lines per column, 8 words per line, 6 letters per word, and 7 b per letter on average. Determine the number of bits required to describe the dictionary, and estimate the number of comparable books that can be stored on a CD.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. R.P. Singh and S D Sapre, *Communication Systems - Analog and Digital*, TMH, 2nd edition 2007.

2. Simon Haykin, *Communication Systems*, John Wiley, 2nd edition 2007.

REFERENCE BOOKS:

1. Herbert Taub & Donald L Schilling, *Principles of Communication Systems*, Tata McGraw-Hill, 3rd Edition, 2009.

2. Sham Shanmugam, *Digital and Analog Communication Systems*, Wiley-India edition, 2006.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/108/104/108104091/

2. https://onlinecourses.nptel.ac.in/noc19_ee47/preview

WEB RESOURCES:

1. https://studiousguy.com/basic-principles-of-communication/

2. https://www.tutorialspoint.com/principles_of_communication/principles_of_communication_modulation.htm

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22EE101702	**RELIABILITY AND SAFETY ENGINEERING**	3	-	-	-	3

Pre-Requisite -
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on the fundamentals of reliability and safety engineering. The course emphasizes on various reliability measures used in assessing the performance of the system, evaluating the critical parameters of the network, and the techniques to assess the reliability of the system. The course also deals with safety management and measures in industrial and other hazardous environments.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. apply the various probability and statistics fundamentals into engineering systems to evaluate performance.
CO2. develop mathematical models for engineering networks/systems to evaluate the critical parameters for the reliability of a network/system.
CO3. analyze the time-dependent/independent characteristics of a repairable system and frequency durations techniques to assess the reliability
CO4. understand various safety management, policy, and planning strategies for personal and industrial safety.
CO5. understand various safety and hazard identification techniques and follow appropriate safety measures in industry and society.

CO-PO Mapping Table

Course Outcome	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	1	1	1	-	-	-	-
CO2	3	3	-	-	2	1	1	-	-	-	-	-
CO3	3	2	-	2	1	1	1	-	-	-	-	3
CO4	3	2	-	-	2	1	1	1	-	-	-	-
CO5	3	2	-	-	2	1	1	1	-	-	-	-
Course Correlation Level	**3**	**2**	**-**	**2**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**3**

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1:   FUNDAMENTALS OF RELIABILITY ENGINEERING   *(09 Periods)*
Random variables, probability concepts, rules for probabilities of events. Probability density and distribution functions. Binomial distribution - Expected value and standard deviation for binomial distribution. Reliability functions, f(t), F(t), h(t) - Relationship between these functions, Exponential density and distribution functions, expected value and standard deviation of exponential distribution. Measures of reliability - MTTF, MTTR, MTBF. Bathtub curve.

Module 2:   NETWORK MODELING AND RELIABILITY EVALUATION   *(09 Periods)*
Basic concepts - Evaluation of network reliability/unreliability, series systems, parallel systems, series - Parallel configuration systems. Redundant systems and its types. Evaluation of network reliability/unreliability using conditional probability method, tie-set and cut-set based approach, complete event tree and reduced event tree methods.

Module 3:   MARKOV CHAIN AND MARKOV PROCESSES   *(09 Periods)*
Basic concepts, stochastic transitional Probability matrix, time dependent probability evaluation, Limiting State Probability, Absorbing states. Modelling concepts – State space diagrams, time dependent reliability evaluation of single component repairable model, two component repairable model. Frequency and duration techniques.

Module 4:   BASICS OF SAFETY CONCEPTS   *(08 Periods)*
Introduction, goals, need for safety, history of safety movement – the evolution of modern safety concept, general concepts of safety management. Planning for safety- productivity, quality and safety, line and staff functions, budgeting for safety, safety policy.

Module 5:   SAFETY TECHNIQUES AND APPLICATIONS   *(10 Periods)*
Introduction to safety techniques, Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, safety sampling, evaluation of the performance of supervisors on safety. Hazard identification techniques, components of safety audit, types of audit, audit methodology, and process of safety reporting. Applications of industrial Safety, environmental safety, health safety, electrical safety, fire safety.

Total Periods: 45

EXPERIENTIAL LEARNING

1. The students shall understand various IEEE reliability standards to be followed in the engineering systems for the evaluation of reliability and asses performance.

2. Should collect various engineering components assembled and their network models for evaluations of network reliability indices.

3. The students to visit a nearby power or process industry to know about various types of failures and repair performance of various engineering components and cause of replacements.

4. Should collect information about various safety/alert sign boards and the relative measures for a particular situation.

5. Should understand the standard practices followed during the maintenance/commissioning of the electrical apparatus in any industry following the various safety precautions.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Roy Billinton and Ronald N Allen, *Reliability Evaluation of Engineering Systems*, 2nd Edition, Springer, New York, 2013.
2. Frank R. Spellman, Nancy E. Whiting, *Safety Engineering: Principles and Practices*, 3rd Edition, Rowman & Littlefield, 2018.

REFERENCE BOOKS:

1. Charles E. Ebeling, *An introduction to reliability and maintainability engineering*, 2nd Edition Tata McGraw-Hill Education, 2010.
2. Dan Petersen, *Techniques of Safety Management: A Systems Approach*, 4th Edition American society of safety engineers, 2003.
3. Ajit Kumar Verma , Srividya Ajit , Durga Rao Karanki*, Reliability and Safety Engineering,* Springer London, 2016.

VIDEO LECTURES:

1. https://nptel.ac.in/courses/105/108/105108128/
2. https://nptel.ac.in/courses/110/105/110105094/
3. https://www.youtube.com/watch?v=uutg8jKrL9w
4. https://www.youtube.com/watch?v=_c-iZ2BAXPw
5. https://www.youtube.com/watch?v=GeMCF3s5EDk
6. https://www.youtube.com/watch?v=xYWyype7cxE

WEB RESOURCES:

1. https://ieeexplore.ieee.org/document/9353567
2. https://www.ualberta.ca/engineering/mechanical-engineering/research/reliability-and-safety.html
3. https://ieeexplore.ieee.org/document/9353567
4. https://www.taylorfrancis.com/books/edit/10.1201/9781003140092/industrial-liability-safety-engineering-dilbagh-panchal-mangey-ram-prasenjit-chatterjee-anish-kumar-sachdeva

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CE101704	**REMOTE SENSING, GIS AND GPS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on photogrammetry, remote sensing, geographic information system, GIS spatial analysis. This course also examines remote sensing and GIS applications, global positioning system and its real-time applications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Analyze photogrammetry and remote sensing to solve complex surveying problems using appropriate tools and techniques following the relevant guidelines and latest developments considering society and environment besides communicating effectively in graphical form.

CO2 Analyze GIS to solve complex surveying problems using appropriate tools and techniques following latest developments besides communicating effectively in graphical form.

CO3 Analyze GIS spatial analysis to solve complex surveying problems using appropriate tools and techniques following latest developments besides communicating effectively in graphical form.

CO4 Analyze remote sensing and GIS applications to solve complex civil engineering problems using appropriate tools and techniques following the relevant guidelines and latest developments considering society, environment, sustainability and management principles besides communicating effectively in graphical form.

CO5 Analyze global positioning system to solve complex surveying problems using appropriate tools and techniques considering society and environment besides communicating effectively in graphical form.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	-	2	2	1	1	1	-	1	-	1
CO2	2	3	-	-	2	1	1	-	-	1	-	1
CO3	2	3	-	2	2	1	1	-	-	1	-	1
CO4	2	3	-	-	2	1	1	1	-	1	1	1
CO5	2	3	-	-	2	1	1	-	-	1	-	-
Course Correlation Mapping	**3**	**3**	**-**	**2**	**2**	**1**	**1**	**1**	**-**	**1**	**1**	**1**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1: PHOTOGRAMMETRY AND REMOTE SENSING (10 Periods)

Photogrammetry: Principle of photogrammetry, Types of aerial photographs, Planning and execution of photographic flights, Geometry of aerial photographs, Scale of aerial photographs and its determination, Stereoscopy, Ground control, Mosaics, Parallax measurements for height determinations, Latest developments in photogrammetry.

Remote Sensing: Elements of remote sensing, Electromagnetic spectrum, Energy resources, Physics of radiant energy, Energy interactions with earth surface features and atmosphere, Data acquisition platforms Spectral reflectance curves, Resolution; Spectral properties of water bodies, soil and vegetation; Sensors and platforms, Visual interpretation techniques.

Module 2: GEOGRAPHIC INFORMATION SYSTEM (09 Periods)

GIS categories, Components of GIS, Fundamental operations of GIS, Spatial and non spatial data, Raster data and vector data, File management, Layer based GIS, Feature based GIS, Map projections, Latest developments.

Module 3: GIS SPATIAL ANALYSIS (08 Periods)

Database models, Data storage, Vector data storage, Attribute data storage, Data manipulation and analysis, Integrated analysis of the spatial and attribute data - DTM/DEM, Softwares – Arc GIS, QGIS and Global mapper, Latest developments in GIS software.

Module 4: REMOTE SENSING AND GIS APPLICATIONS (09 Periods)

Land use/Land cover classification, Rainfall-runoff studies, Flood and drought impact assessment and monitoring, Drainage morphometry, Watershed management for sustainable development, GIS based precision farming, GIS based natural resources management, Inland water quality survey and management, Regional and urban planning and management, GIS based highway alignment, GIS based traffic congestion analysis, GIS for public health – Case Studies.

Module 5: GLOBAL POSITIONING SYSTEM (09 Periods)

Global Positioning System (GPS) – Fundamental concepts, Components of GPS – Space segment, Control segment, User segment, Reference systems, Satellite orbits; Classification of GPS receivers, GPS observations, GPS measurements and accuracy of GPS, Applications.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Sound composing project: In this assignment, Select area and collect the geometry of aerial photographs and analyze the views.

2. Visit any meteorological department and understand about rain gauges and collect, analyse the data

3. Visit Geographical Information Systems Laboratory and understand about GIS and GPS Systems

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Shivam, P. and Shashikanth, T., *A Text Book of Basic Concept of Remote Sensing, GPS and GIS*, Sankalp Publication, 2020.
2. Anji Reddi, M., *A Text Book of Remote Sensing and Geographical Information Systems*, B. S. Publications, 2nd Edition, 2012.

REFERENCE BOOKS:

1. Bhatta, B., *Remote Sensing and GIS*, Oxford University Press, 2nd Edition, 2011.
2. Lillesand, T. M., Kiefer, R. W. and Chipman, J. W., *Remote Sensing and Image Interpretation*, John Willey and Sons (Asia) Pvt. Ltd., 7th Edition, 2014.
3. Chandra, A. M. and Ghosh, S. K., *Remote Sensing and Geographic Information System*, Narosa Publishing House, 2nd Edition, 2015.
4. Panigrahi, N., *Geographical Information Science*, University Press, 2nd Edition, 2013.
5. Peter A. Burragh and Rachael Mc Donnell, *Principles of Geographical Information Systems*, Oxford University Press, 2nd Edition, 2014.

VIDEO LECTURES:

1. http://nptel.ac.in/courses/105/107/105107206/

2. https://syslab.ceu.edu/videos/geospatial-technologies

WEB RESOURCES:

1. Digital Audio Signal Processing: https://www.udemy.com/course/introduction-to-geospatial-technologies-and-arcgis-interface/

2. Learn Audio Editing - for Beginners: https://www.youtube.com/watch?v=xGgaV9r_kH8

3. https://storymaps.arcgis.com/stories/47e984aae614442cb80aa40d121b5fe

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CE101705	**SMART CITIES**	3	-	-	-	3

Pre-Requisite -

COURSE DESCRIPTION: This course provides a discussion on smart city and infrastructure, smart governance, smart mobility, smart economy, smart environment, smart buildings, smart energy, smart water, smart living, smart people and case studies.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1 Understand the concept of smart cities and its infrastructure for ensuring safety and sustainability using appropriate techniques and management principles in India besides lifelong learning.

CO2 Analyse smart cities to solve problems associated with mobility and governance for the growing population by ensuring safety and sustainability, management using appropriate standards in India besides lifelong learning.

CO3 Analyse smart cities to solve problems associated with economy and environment for ensuring safety and sustainability, management using appropriate techniques and standards in India besides lifelong learning.

CO4 Analyse buildings, energy and water resource systems in smart cities to solve problems associated with the growing population for ensuring safety and sustainability, management using appropriate standards in India besides lifelong learning.

CO5 Analyse the smart cities to solve complex problems associated with people and living systems for ensuring safety and sustainability, management using appropriate techniques in India besides lifelong learning.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	2	3	1	2	-	1	1	2
CO2	3	3	-	1	2	3	3	2	-	1	1	2
CO3	3	3	-	1	2	3	3	2	-	1	1	2
CO4	3	3	-	1	2	3	3	3	-	-	1	2
CO5	3	3	-	1	2	3	3	2	-	-	1	2
Course Correlation Mapping	**3**	**3**	**-**	**3**	**2**	**2**	**2**	**2**	**-**	**1**	**1**	**2**

Correlation Levels: *3: High;* *2: Medium;* *1: Low*

COURSE CONTENT

Module 1:   SMART CITY AND INFRASTRUCTURE   *(09 Periods)*
Smart city - Concept, Objectives, History, Need; Key trends in smart city development, Government of India – Policy for smart city.
Infrastructure: Smart city infrastructure – Components, Challenges; Managing - Principle stake holders, Infrastructure in India and World, Dimensions of smart cities, Global standards and performance benchmarks, Practice codes, Infrastructure development, Integrated infrastructure management systems for smart city, Infrastructure management system applications for existing smart city, Various types of infrastructure systems, Infrastructure assessment.

Module 2:   SMART GOVERNANCE AND SMART MOBILITY   *(09 Periods)*
Smart Governance: Definition, smart governance to citizens, Industries and commerce, Smart governance within government, Emerging trends in smart governance, Future of smart governance, Guidelines and standards for smart governance; IOT and ICT Application – Broadband city, Use of sensors, Intelligent city governance.
Smart Mobility: Intelligent transportation systems, Accessibility, Smart vehicles and fuels, GIS, GPS, Navigation system, Public transport, Traffic safety management, Logistics flows in cities, Mobility services, E-ticketing.

Module 3:   SMART ECONOMY AND SMART ENVIRONMENT   *(09 Periods)*
Smart Economy: City branding, Market places and crowd funding, Innovation, entrepreneurship – E-business, E-commerce, Online integrated business platforms and networks; Local and global interconnectedness, Productivity, Flexibility of labour market.
Smart Environment: Network and environmental monitoring, Energy efficiency, Urban planning and urban refurbishment, Smart buildings and building renovation, Resource management, Environmental protection.

Module 4:   SMART BUILDINGS, SMART ENERGY AND SMART WATER   *(09 Periods)*
Smart Buildings: Definition, Sustainable city – A green approach, Housing, Sustainable green building - Solar energy for smart city, Waste water management, solid waste management, 3Rs Policy, Green ratings.
Smart Energy: Current energy demand, Alternate energy sources, Renewable energy, Production, Solar energy, Wind energy, Energy from solid waste, Applications, Challenges in smart energy
Smart Water: Storage and conveyance system of water, Sustainable water and sanitation, Sewage systems, Flood management, Conservation system.

Module 5:   SMART LIVING, SMART PEOPLE AND CASE STUDIES   *(09 Periods)*
Smart Living: Definition, Cultural facilities, World-class education, Tourist attractions, World-class hospitals, Latest technologies, Quality housing, Community and urban life management, Social cohesion.
Smart People: Definition, Human development index, Level of qualification, Graduate enrolment ratio, Lifelong learning, ICT Skills, Quality of smart people – Flexibility, Creativity to contribute to education, Democratic nature; Personality dimensions – Extroversion, Agreeableness, Consciousness, Emotional Stability, Open to experience.
Case Studies: Helsinki – Finland; Zurich - Switzerland; Oslo - Norway; Amsterdam - The Netherlands; New York - United States; Seoul (World's first Smart City) - South Korea.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1. Prepare a report on smart city infrastructure for south Indian cities.
2. Prepare a review on need for changes in transportation and governing policies in India.
3. Write a report on energy conservation and economy stability in world's first smart city.
4. Write a report on need and technologies to be adopted for green buildings in a smart city.

5. Prepare a case study report on Hyderabad, Telangana.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Li Xian Yi, *Smart City on Future Life - Scientific Planning and Construction*, Posts and Telecom Press, 2012.
2. Arpan Kumar Kar, Manmohan Prasad Gupta, P. Vigneswara Ilavarasan and Yogesh K. Dwivedi, *Advances in Smart Cities*, CRC Press, Taylor & Francis Group, Boca Raton, 2017.

REFERENCE BOOKS:

1. Nicos Komninos, *The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities)*, Routledge Taylor & Francis Group, London, 2015.
2. Eleonora Riva Sanseverino, *Smart Rules for Smart Cities – Managing Efficient Cities in Euro-Mediterranean Countries*, springer for innovation, Springer, Italy, 2014.
3. Smart Cities Mission: A Step Towards Smart India, National Portal of India
4. Anthony M. Townsend, *Smart Cities – Big Data, Civic Hackers and The Quest for a New Uthopia*, W. W. Norton & Company, Inc., New York, 2013.
5. IoT Technician (Smart City) – MHRD, Govt. of India, 2nd Edition, 2022.

VIDEO LECTURES:

1. City of the Future: Singapore – Full Episode | National Geographic - YouTube
2. Integrated Waste Management for a Smart City - Course (nptel.ac.in)

WEB RESOURCES:

1. Smart Cities (nationalgeographic.org)
2. NPTEL :: Civil Engineering - NOC: Sustainable Materials and Green Buildings
3. Smart cities (europa.eu)
4. Top 7 Smart Cities in the World in 2023 (earth.org)

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22EC101706	**SMART SENSORS FOR ENGINEERING APPLICATIONS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on Basics of sensors, characteristics of sensors and their responses; Smart sensors for Engineering, Science and Health Monitoring Applications; Applications of smart sensors and advancements in sensing Techniques.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Analyse the characteristics of transducers and estimate the response of sensors.

CO2. Understanding the working of various sensors in the context of their specialised domains.

CO3. Apply smart sensors for real time applications.

CO4. Apply the advanced techniques to smart sensors to provide solution to real time applications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   CONCEPTS OF SENSORS   *(08 Periods)*

Introduction to sensors and transducers. Need for sensors in the modern world. Different fields of sensors based on the stimuli, various schematics for active and passive sensors. Static and dynamic characteristics of sensors. **zero, I and II order sensors:** Response to impulse, step, ramp and sinusoidal inputs. Environmental factors and reliability of sensors.

Module 2:   SENSORS IN ENGINEERING   *(07 Periods)*

Physical principles of sensors, Electric Sensors: Resistive, Capacitive, Inductive. Piezoelectric sensor. Photo elastic sensors, Fluid Mechanic sensors.

Module 3:   HUMAN AND BIOMIMETIC SENSORS   *(10 Periods)*

Human sensors: vision, Taste and smell, Hearing, Somatic, Biomimetic Sensors, Electrochemical, Thermoelectric sensors, Optic sensors.

Module 4:   APPLICATIONS OF SMART SENSORS   *(11 Periods)*

WSN Based Physiological Parameters Monitoring System: Measurement of Human Body Temperature. Intelligent Sensing System for Emotion Recognition: Aim of the Emotion Recognition System, Development of Intelligent Sensing System for Emotion Recognition. WSN Based Smart Power Monitoring System.

Module 5:   ADVANCEMENTS IN SENSING TECHNOLOGY   *(09 Periods)*

Ecological Monitoring Using Wireless Sensor Networks: Overview, Challenges, and Opportunities. Development of an Embedded System-Based Gateway for Environmental Monitoring in Wild Fields. Advancements in Structural Health Monitoring.

Total Periods: 45

EXPERIENTIAL LEARNING

1.   Build a wireless sensor system for Environmental pollution monitoring.

2.   Design a smart temperature measurement system using required accessories.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1.   Patrick F Dunn, *Fundamentals of sensors For engineering and science*, CRC Press,2012.

2.   Subhas C. Mukhopadhyay, Krishanthi P. Jayasundera, and Anton Fuchs, *Smart Sensors, Measurement and Instrumentation*, Springer,2013.

REFERENCE BOOKS:

1.   Subhas Chandra Mukhopadhyay*, Intelligent Sensing, Instrumentation and Measurements*, Springer, Kluwer Academic Publishers,2013.

2.   Henry Bolte, *Sensors – A Comprehensive Sensors,* John Wiley.

VIDEO LECTURES:

1.   https://www.youtube.com/watch?v=oRydUfgMdgA

2.   https://onlinecourses.nptel.ac.in/noc22_ee36/

WEB RESOURCES:

1.   https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1199&context=nasapub#:~:text=The%20smart%20materials%20examined%20include,%2C%20magneto%2Doptical%20materials%2C%20and

2.   https://www.youtube.com/watch?v=q8UuRkOQ9A0

3.   https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8433768/

4.   https://www.mdpi.com/1424-8220/21/17/5890

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22EE101703	**SUSTAINABLE ENERGY SYSTEMS**	3	-	-	-	3

Pre-Requisite –
Anti-Requisite -
Co-Requisite -

COURSE DESCRIPTION: This course designed emphasizes the operating principle of a range of non-conventional energy resources, energy harvesting and conversion principles and key performance characteristics. The energy conversion technologies will include energy conversion from, Solar, Wind, Ocean, Biomass, Geothermal and Fuel cells. The course also emphasizes on various types of hybrid energy storage systems with their relative advantages and disadvantages.

COURSE OUTCOMES: After successful completion of the course, students will be able to:
CO1 Understand the fundamental concepts of renewable energy sources and their endurance for sustainability.
CO2 Understand the various methods of harvesting solar energy, energy conversion principles, and operational aspects and environmental impacts of solar technologies.
CO3 Understand the various methods of harvesting wind energy, conversion principles, operational aspects, and environmental impacts of wind energy systems.
CO4 Understand the various methods of harvesting ocean energy, Biomass energy and geothermal energy, energy conversion technologies, operational aspects, and their impacts on the environment.
CO5 Understand the principle of harvesting energy from fuel cells and the operational aspects of hybrid energy storage systems.

CO-PO Mapping Table:

Course Outcome	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	2	2	-	-	-	-	1
CO2	3	-	-	-	2	2	2	-	-	-	-	1
CO3	3	-	-	-	2	2	2	-	-	-	-	1
CO4	3	-	-	-	2	2	2	-	-	-	-	1
CO5	3	-	-	-	2	2	2	-	-	-	-	1
Course Correlation Mapping	**3**	-	-	-	**2**	**2**	**2**	-	-	-	-	**1**

Correlation Levels: **3: High;**   **2: Medium;**   **1: Low**

COURSE CONTENT

Module 1:   INTRODUCTION TO SUSTAINABLE ENERGY SOURCES   *(07 Periods)*

Impact of conventional sources on Environment—acid rain, ozone layer depletion, Global warming, greenhouse effect and nuclear waste; Limitation of fossil fuels; Renewable energy sources; Renewable sources and their sustainable development.

Module 2:   ENERGY FROM SOLAR   *(10 Periods)*

Introduction, solar radiation, Measurement of solar radiation—Pyranometer; Solar energy collectors; Flat plate collectors— Liquid and air (non-porous) types; Focusing type— Parabolic and Point types; Solar photovoltaic system— PV cell and its types, Configuration of solar panel, PV system; Applications: Solar pump, Solar water heater

Module 3:   ENERGY FROM WIND   *(08 Periods)*

Introduction, power extraction from the wind, Wind turbines— Horizontal axis wind turbine— Propeller type and Vertical axis wind turbine— Darrieus rotor type; Basic components of wind energy conversion systems, Applications: Energy storage, Water pumping; Environmental impacts.

Module 4:   ENERGY FROM OCEAN, BIOMASS AND GEOTHERMAL   *(12 Periods)*
**   RESOURCES**

Energy from ocean: Introduction, ocean thermal energy conversion (OTEC): Open and closed cycle power plants; Tidal energy: Schematic diagram of tidal power plant; Advantages and disadvantages.

Energy from Biomass: Introduction, biomass conversion technologies-direct, Thermochemical and Biochemical conversions; Biogas generation—Anaerobic digestion process.

Geothermal energy: Introduction, Geothermal resources, Geothermal power plants— Vapour dominated and liquid dominated; Environmental issues.

Module 5:   FUEL CELLS AND HYBRID ENERGY SYSTEMS   *(08 Periods)*

Fuel Cells: Introduction, principle and operation of fuel cell, classification of fuel cells, advantages and disadvantages of fuel cells.

Hybrid energy systems: Need for hybrid systems, configuration and coordination, Block diagram approach of Stand-alone PV-wind system, PV-Diesel and Wind-diesel; energy storage systems — Ultra capacitors, SMES, Battery.

Total Periods: *45*

EXPERIENTIAL LEARNING

1.   The students shall visit a solar power plant, understand the operational aspects and should prepare a technical report on the plant visited.

2.   The students shall visit a wind farm, understand the operational aspects, and should prepare a technical report on the plant visited.

3.   The students shall visit a bio-mass energy conversion plant, understand the operational aspects and should prepare a technical report on the plant visited.

4.   The students shall prepare a technical report on the need of a hybrid plant and find new avenues for a new hybrid system.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXT BOOKS:

1. Rai, G.D., *Non-conventional Energy Sources*, Khanna Publishers, New Delhi, 2017.
2. G.N. Tiwari and M.K. Ghosal, *Renewable energy resources: Basic principles and applications*, Alpha Science International Ltd., 2005.

REFERENCE BOOKS:

1. JhonTwidell and Tony Wier, *Renewable Energy Resources*, Taylor & Francis, 2nd edition, London and Newyork, 2006.
2. K.M. Mittal,*Non-conventional Energy Systems-Principles*, Progress and Prospects, Wheeler Publications, 1997.
3. S.Rao, Dr.B.B. Parulekar, *Energy Technology*, Third edition, Khanna Publications, 2013.
4. R. K. Rajput, *A textbook of power system engineering*, Laxmi publications (P) Ltd, 2016

VIDEO LECTURES:

1. https://nptel.ac.in/courses/103103206

2. https://nptel.ac.in/courses/121106014

3. https://youtu.be/mh51mAUexK4

4. https://youtu.be/UW4HYJ36q0Y

WEB RESOURCES:

1. www.mnre.gov.in

2. www.ireda.in

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22CS101702	**WEB DESIGN FUNDAMENTALS**	3	-	-	-	3

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course is designed to introduce the student to the technologies and facilities of web design: CSS, javascript, and jquery. Students will understand the web design process and use these software technologies together to produce web design projects.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the fundamentals of HTML 5 and the principles of web design.

CO2. Construct basic websites using HTML and Cascading Style Sheets.

CO3. Build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.

CO4. Learn how to use HTML5 and other Web technologies to develop interactive and responsive web pages.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	2	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	2	-
CO4	2	3	3	-	-	-	-	2	-	-	-	-
Course Correlation Mapping	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**2**	**-**

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   INTRODUCTION   *(09 Periods)*

Elements – Data types - Working with Text - Arranging Text - Displaying Lists - VAR Element - BDO Element - SPAN Element – DIV Element.

Module 2:   LINKS AND URLS   *(09 Periods)*

Hyperlinks – URLs - Linking to a Mail System - Creating Tables - Inserting Images in a Web Page – Colors – Form Elements - Multiple-Choice Elements – Multimedia

Module 3:   DYNAMIC HTML   *(09 Periods)*

Features of JavaScript - Programming Fundamentals - JavaScript Functions, Events, Image Maps, and Animations – JS Objects - Document Object - Validation, Errors, Debugging, Exception Handling, and Security

Module 4:   CASCADING STYLE SHEET   *(09 Periods)*
CSS Syntax - CSS Selectors - Backgrounds and Color Gradients - Fonts and Text Styles - Creating Boxes and Columns - Displaying, Positioning, and Floating an Element - Table Layouts - : Effects, Frames, and Controls in CSS

Module 5:   ADVANCED FEATURES OF HTML5   *(09 Periods)*
Creating Editable Content - Checking Spelling Mistakes - Custom Data Attributes - Client-Side Storage - Drag and Drop Feature - Web Communication –**jQuery -** Fundamentals of jQuery - Callback Functions - jQuery Selectors - jQuery Methods to Access HTML Attributes.

Total Periods: 45

EXPERIENTIAL LEARNING

1.   Design a blog layout that includes header, navigation menu, content area, sidebar. Apply appropriate styling to each section.
2.   Develop a java script based quiz that presents MCQs to the user and provides immediate feedback on their answers. Keep track of the score and display the final results at the end.
3.   Build a web page that displays and image gallery. Each image should be a clickable link that opens the image in a larger view when clicked.

(Note: It's an indicative one. The course instructor may change the activities and the same shall be reflected in course handout.)

RESOURCES

TEXTBOOKS
   1.   DT Editorial Services, *HTML 5 Black Book*, Dreamtech Press, 2nd Edition, 2016.

REFERENCE BOOKS
   1.   Jennifer Niederst Robbins, *HTML5 Pocket Reference,* O'Reilly, 5th Edition, 2018.
   2.   Ben Frain, *Responsive Web Design with HTML5 and CSS3*, Packt, 2nd Edition, 2020.

VIDEO RESOURCES
   1.   https://www.youtube.com/watch?v=h_RftxdJTzs
   2.   https://www.youtube.com/watch?v=dlkWNdnO8ek

WEB RESOURCES
   1.   https://www.w3schools.com/html/
   2.   https://www.w3schools.com/css/
   3.   https://www.geeksforgeeks.org/web-technology/
   4.   https://www.smashingmagazine.com/2021/03/complete-guide-accessible-front-end-components/
   5.   https://css-tricks.com/
   6.   https://davidwalsh.name/css-optional

UNIVERSITY ELECTIVE

Course Code	Course Title	L	T	P	S	C
22SS101706	**WOMEN EMPOWERMENT**	3	-	-	-	3

Pre-Requisite   -

Anti-Requisite   -

Co-Requisite   -

COURSE DESCRIPTION: Concept & Framework, Status of Women, Women's Right to Work, International Women's Decade, and Women Entrepreneurship.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1   Demonstrate the knowledge of the characteristics and achievements of empowered women and women's empowerment techniques by analyzing women's legal and political status.

CO2   Apply the knowledge of women's rights by analyzing various societal issues and obstacles in different fields, including science and technology.

CO3   Demonstrate the knowledge of the significance of women's participation in policy debates, National conferences, and common forums for equality and development by identifying and analyzing issues.

CO4   Analyze the concept of women's entrepreneurship, government schemes, and entrepreneurial challenges and opportunities.

CO-PO Mapping Table

Course Outcomes	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	-	-	1	3	-	1	–	–	-	-
CO2	3	1	-	-	-	2	-	-	-	–	-	-
CO3	3	1	-	-	-	2	-	-	-	3	-	-
CO4	3	1	-	-	-	-	-	-	-	-	2	-
Course Correlation Mapping	3	1	-	-	1	3	-	1	–	3	2	-

Correlation Levels: 3: High;   2: Medium;   1: Low

COURSE CONTENT

Module 1:   CONCEPT & FRAMEWORK   *(09 Periods)*

Introduction– Empowered Women's Characteristics – Achievements of Women's Empowerment **Concept of Empowerment:** Meaning & Concept – Generalizations about Empowerment – Empowerment Propositions – Choices women can make for empowerment – Women's participation in decision making, development process & in Governance. **Framework for Empowerment** – Five levels of equality – Tenets of Empowerment– Elements – Phases and aspects – Techniques – Categories and Models – Approaches.

Module 2:   STATUS OF WOMEN   *(09 Periods)*

Legal Status: Present Scenario – Call for Social Change – Significant Trends – Legal & Schemes – Personal Law – Joint Family – Criminal Law – Shift towards Dowry – Deterrent Punishment – Criminal Law (II Amendment) – Discrimination in Employment.

Political Status: Present Scenario – Political Participation & its NatureSocio–economic Characteristics – Political Mobilization: Mass Media – Campaign Exposure – Group Orientation – Awareness of issues and participation – Progress & Future Thrust.

Module 3:   WOMEN'S RIGHT TO WORK   *(09 Periods)*

Introduction – Present Scenario – Changes in Policy & Programme – National Plan of Action– Women's Cells and Bureau – Increase in the work participation rate – Discrimination in the labour market – Women in unorganized sector – Issues and Obstacles– Women in Education – Women in Science & Technology – Case Study: Linking Education to Women's Access to resources.

Module 4:   WOMEN'S PARTICIPATORY DEVELOPMENT   *(09 Periods)*

Dynamics of social change – conscious participation – Information Explosion – Organized Articulation – National Conference – Common Forums – Participatory Development – New Issues Identified – Role of other Institutions.

Module 5:   WOMEN ENTREPRENEURSHIP   *(09 Periods)*

Introduction – Definition – Concept – Traits of women Entrepreneurs – Role of Women Entrepreneurs in India – Reasons for Women Entrepreneurship – Government schemes & Financial Institutions to develop Women Entrepreneurs – Key policy recommendations – Project Planning – Suggestions and measures to strengthen women entrepreneurship – Growth & Future challenges – Training and Opportunities – Case Study: Training Women as Hand–pump Mechanics– Case Study: Literacy for Empowering Craftswomen

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare poster presentation on "impact of women's self-help groups on their empowerment and socio-economic development."

2. Prepare a comparative analysis chart on the status of women in various countries.

3. Prepare a presentation on women and cultural responsibilities in different societies.

4. Prepare a presentation on the women of the past, present and future in terms of responsibilities and duties.

5. Prepare a presentation on the great women entrepreneurs of India.

(Note: It's an indicative one. Course Instructor may change activities and shall be reflected in course Handout)

RESOURCES

TEXT BOOKS:

1. SahaySushama, *Women and Empowerment,* Discovery Publishing House, New Delhi, 2013.

2. NayakSarojini, Jeevan Nair, *Women's Empowerment in India*, Pointer Publishers, Jaipur, 2017.

REFERENCE BOOKS:

1. Baluchamy. S, *Women's Empowerment of Women*, Pointer Publishers, Jaipur, 2010.

2. Khobragade Grishma, *Women's Empowerment: Challenges and Strategies Empowering Indian Women*, Booksclinic Publishing, Chhattisgarh, 2020.

WEB RESOURCES:

1. https://www.economicsdiscussion.net/entrepreneurship/women–entrepreneurs–in–india

2. https://www.businessmanagementideas.com/entrepreneurship–2/women entrepreneurs